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U. S. DEPARTMENT OF AGRICULTURE.

ARBOR DAY:

ITS HISTORY AND OBSERVANCE.

BY

N. H. EGLESTON.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1896.

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LETTER OF SUBMITTAL.

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U. S. Department of Agriculture,
Washington, D. C., January 29, 1896.

Sir: I have the honor to submit the accompanying bulletin on Arbor Day, prepared by your direction.

Its aim is to give an authentic account of the origin, history, and uses of the day—now observed throughout our country and also in other lands—which has been regarded with interest by the Department ever since its observance began, and to offer such suggestions and helps as may serve to increase its usefulness.

It is impossible to sketch the history of Arbor Day in even the briefest manner without frequent reference to the present Secretary of the Department, with whom the day is so intimately connected. If the writer of this bulletin had felt at liberty to disregard the restraints imposed by the official character of the work, a much more frequent mention of Mr. Morton's name would have been the result.

Some of the illustrations in the bulletin, especially those of leaves, are from Apgar's Trees of the Northern United States, copyright, 1892, by the American Book Company, to whom thanks are due for permission to use them, it having been found impracticable to prepare original figures of this character without delaying the bulletin until after the arrival of the time set apart in many States for the observance of Arbor Day. Similar thanks are due to others also for like favors.

I take occasion here also to thank the superintendents of public instruction and others who have so readily and courteously responded to my invitation and rendered aid, by suggestion or otherwise, in the preparation of this publication. Wherever material from such or other sources has been incorporated in these pages I have endeavored to give credit to the respective authors. For the rest the writer is responsible.

Respectfully,

N. H. Egleston.

Hon. Chas. W. Dabney, Jr.,
Assistant Secretary.

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INTRODUCTION.

Arbor Day, from being only a humble expedient of one of our Western States a few years ago, has become a national holiday and one of our important institutions. Its original design has been modified since its observance has become associated with our schools. It is now not only a day for tree planting for economic and æsthetic purposes, but its observance has been made the means of securing much valuable knowledge in regard to plant and tree life, of cultivating in the young the powers of observation, and kindling in their minds an interest in natural objects which will be a lifelong source of benefit and pleasure.

Is it too much to hope, also, that this Arbor Day festival, engaging our children in its observance so generally and so pleasantly with songs, recitations, and the planting of trees and shrubs around the schoolhouses and along the streets or in public parks and other places, may have the effect of developing in coming generations a keener appreciation of the value and the beauty of trees than has hitherto been felt in our country, and that thus the reckless destruction of our forests, now going on with such threatening consequences, may be arrested before the calamities are upon us which have befallen other countries through the loss of their trees?

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ARBOR DAY: HISTORY AND OBSERVANCE.

COMMERCIAL VALUE OF TREES.

Arbor Day has its abundant justification in the surpassing value of trees from whatever point of view they are considered. Their beauty is felt by all. Nothing contributes so much to make the world a pleasant place of abode for man. Just as anyone has the true home feeling and seeks to create a home for himself, he seeks the trees as being an indispensable aid in the accomplishment of his purpose. He must have the trees around his dwelling place. He must have their shelter and their shade, their beauty of form, of leaf, and blossom, and fruit, their ever-varying aspect with every change of earth and sky, of sunshine and cloud. In short, he must have their companionship in his daily life. But looked at apart from all such feeling and sentiment, looked at not in their living but in their dead state, looked at as mere lumber or material for man's constructive purposes, for the thousand uses of daily life, the trees have an almost incomparable value. Estimated by their money value alone the products of the forest exceed those from almost any other source.

We speak of the "precious metals," gold and silver; and they are so precious in the esteem of most persons that multitudes are ready to forsake all other occupations and rush in pursuit of them wherever they may be found or there is even a faint hope of finding them. Now we give to the hunters of these precious metals special privileges in the prosecution of their quest such as are not given to people engaged in other employments. It would seem that the mining of gold and silver is the most important interest of the country. It certainly holds a very prominent position in the public estimation.

But the last report of the Director of the Mint gives the value of the product of the gold and silver mines of the United States for the year 1894 as follows: Gold, $39,500,000; silver, $31,422,000; total, $70,922,000. At the same time, the most recent and careful estimates of the value of

the products of our forests during the same year make it $1,058,650,859, or fifteen times that of gold and silver.

Another comparison is very significant. If we add to the gold and silver products that of all other minerals, including such prominent ones as iron, copper, lead, zinc, coal, lime, natural gas, petroleum, salt, slate, building stones, and the twenty-five or more remaining, which are less important, we shall have for the value of all our mineral products obtained during the year 1894, $553,352,996, or only about one-half the value of our forest products.

Again, we may make a comparison in a different direction and with no less striking results. The statistical report of the Department of Agriculture gives the value of our cereal crops for the year 1894 as follows:

Wheat	$225,902,025
Corn	554,719,162
Oats	214,816,920
Rye	13,395,476
Barley	27,134,127
Buckwheat	7,040,238
Total	1,043,007,948

or less by $15,000,000 than our one forest crop.

Is it not worth our while, therefore, to perpetuate if possible such a crop, and to guard against anything which threatens to diminish it? Ought we not, by every means within our control, to see that the source of this most valuable supply is not lessened in its capability of yielding such a preeminently valuable contribution to our welfare and comfort?

The need of tree planting, looked at in the wide view, results from the fact that we have been and are depleting our forest area at an unreasonable rate. The spread of population into the great treeless plains beyond the Mississippi has made a largely increased demand for lumber, and in response to that demand we have been for years consuming our forests at a rate far beyond the supply furnished by their annual growth. The best estimates make the annual consumption of our forests, for fuel and lumber chiefly, 25,000,000,000 cubic feet. To furnish this amount would require the produce of the annual growth of 1,200,000,000 acres of woodland, whereas our total forest area is less than 500,000,000 acres, which is no more than we need as a permanent stock of woodland for the country. It will be seen, then, that more than half of our annual consumption is a draft by so much upon our forest capital, when we should be only drawing from the forests the amount of their annual growth, or the interest of that capital. How long would it take a millionaire to become a bankrupt if he should be annually trenching upon his money capital at a like rate?

Few persons realize the enormous and often wasteful—that is, unnecessary—consumption of our forests. That consumption amounts

to 350 cubic feet per capita, as against 12 to 14 cubic feet per capita in Great Britain and about 40 cubic feet in Germany.

Some specifications may help us to apprehend the situation. Our railroads consume, on an average, annually for their construction 500,000,000 cubic feet of our very best timber. Our mines use for internal props and for the reduction of their ores immense amounts. One mine may be taken as an illustration. The Anaconda Mining Company, of Montana—well named Anaconda, in view of its enormous capacity for swallowing the forests whole, as it were—made a statement four years ago, now on file in one of the Departments of the Government, from which it appears that during a period of six months it consumed 65,000 cords of wood and 18,500,000 feet of lumber. At the same time the company stated that its daily consumption hereafter would be, wood 700 cords, lumber 100,000 feet, and its consumption for the year 1892 would be, wood 255,000 cords, lumber 40,000,000 feet. This lumber is mostly in the form of timber used as mine props.

Most of the wood and timber used by this and other mines in the Rocky Mountain and other western regions is cut from the public lands. Such is the indulgence shown by the Government that those engaged in mining or even prospecting for mines are allowed to cut and consume the timber on the public lands free of cost and with only such restrictions as may be made by the Secretary of the Interior. These restrictions are not close or narrow in character, and are easily evaded if not absolutely ignored, and so are to a great extent practically inoperative. The scanty appropriations of Congress do not allow the Secretary of the Interior to retain a sufficient number of inspectors to watch the immense extent of territory occupied by the forests and take notice of the depredations which may be made upon them, and even when depredations are occasionally discovered it is very difficult to secure a conviction and inflict the penalty prescribed for the offense.

To show the extent of these depredations and the scale on which the forests are consumed, may be instanced the case of one mining company in Dakota against which the Government has brought suit for the sum of $688,000, this being the alleged value of the trees cut less than 8 inches in diameter, which restriction had been placed upon the permit to cut. What must have been the number and value of the larger trees cut and consumed by this company? The operations of the Anaconda Company are carried on upon so large a scale that it is said they refuse to make a contract for less than 40,000 cords of wood in any single case, and their contracts range from that amount to 200,000 cords, while nearly 1,000,000 cords are constantly kept on hand. The company held last year a permit from the Secretary of the Interior to cut from four sections of public land within twelve months 14,000,000 feet of timber. The great Comstock Lode of Nevada is, if possible, a greater anaconda, whole mountains of forest having gone into its capacious

maw, the growth of two or three centuries having been swept away in a few years.

Figures are impotent to give one a full apprehension of the work of forest destruction that is wrought by these and other mining companies and the lumbering establishments which help them to their supplies. One needs to see with his own eyes the work as it is going on and the track of desolation which it leaves, to have an adequate notion of the destruction thus accomplished. One company, miscalled a development company, which is one of the agencies through which the Anaconda secures its supplies, has a daily capacity of 120,000 feet of timber.

It is to be considered also that not only the consumption of the forests incidental to mining operations but that resulting from ordinary lumbering is marked by great wastefulness. We throw away often more material than we use. A great portion of the substance of the trees cut in the forests is left there to decay or to be consumed by the flames. It is estimated that on the average not more than three-eighths of what we cut in the forests is utilized, five-eighths of the material being wasted. In the great redwood forests of the Pacific Coast such is the wasteful method of operation, it is said, that in procuring a railroad tie worth 35 cents, $1.87 worth of the substance of the tree is wasted. In Europe it is estimated that seven-eighths of the forest material is made use of and the waste is only one-eighth.

A conspicuous case of wastefulness is worth noting in this connection, not only as an instance of wastefulness, but for the great and direct damage resulting from it. To meet the demands of a great mining company on one of the Sierra Nevada ranges a band of men, numbering thousands in all, were sent with their axes into a forest district in that vicinity. It was an extensive region and the forest presented a stand of trees not excelled, perhaps, in quality in all the country. Every condition of climate and soil had been favorable for their growth. They stood thick and stalwart.

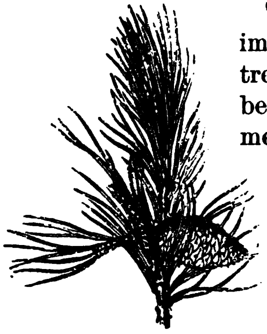
As the quickest and easiest way of getting out the largest trees, which were the ones wanted for the miners' use, the forest was cut clean and leveled with the ground. Then, the timber having been removed, the remaining trees, spread over miles and miles of the mountain side, were given to the flames. The fire not only consumed the trees, but burned up the soil beneath them—the rich leaf mold, which was the accumulation of centuries of tree growth. The very rocks beneath it were so heated by the mighty mass of burning fuel that, in many places, they crumbled to gravel. When the rains came and the snows melted rapidly in springtime—having no sheltering foliage of the trees to protect them from the rays of the sun—the ashes of the burned trees, and what was left of the soil, together with the rocky gravel, were swept down the mountain side with torrent swiftness and force, overflowing the banks of the water courses, tearing

them from their places, and pouring out the débris of disintegrated rock upon the fertile meadows below to the depth of many feet.

The settlers in the peaceful valleys at the foot of the mountains, to whom the dense forests had sent from their saturated spongy soil and the slowly melting snows under their protecting shade a steady and sufficient supply of water to enable them to prosecute their farming operations in that arid region with an assurance of success nowhere surpassed, now found themselves at the mercy of torrents in the spring season and droughts in the summer time, and were forced to abandon their no longer productive farms. Those green mountain slopes which it had taken centuries of growth to prepare as the guarantee of fertility to the fields below are gone. Naked rocks only are now to be seen in their place. It will take centuries to clothe them again with trees, and meanwhile the valleys and plains below will remain the desert which the greed and recklessness of man have created there.

With the enormous consumption of our forests now going on and rapidly increasing and the consequent diminution of our forest area, the need of tree planting becomes greater with every passing year, and the importance of Arbor Day constantly increases. Its great value, as has been said, is not so much in the number of trees planted on Arbor Day as in the tree sentiment created and stimulated by the Arbor Day observances, which will be helpful in arresting the wasteful destruction of our forests and lead on in due time, it is to be hoped, to all private and public tree planting which our interests demand.

ORIGIN AND HISTORY OF ARBOR DAY.



The first to call attention in this country, in an impressive way, to the value and absolute need of trees—their value not merely on account of their beauty or their adaptation for purposes of ornamental planting and mechanical utility, but for their connection as forests with climatic influences, with the flow of streams, and their consequent connection with the large interests of agriculture and commerce, in short, with the general welfare of all classes of people—was that eminent scholar and wise observer, Mr. George P. Marsh, for many years our worthy representative at the courts of Italy and Turkey. His residence in those older countries was calculated to draw his attention to the subject as it would not have been drawn had he always lived in his native land.

Ours was a remarkably well-wooded country. From Maine to the Gulf and from the Atlantic coast to the Alleghanies stretched an almost continuous forest, which at the beginning of white settlements

here and long afterwards was an impediment to agricultural development. The pioneer was obliged to clear a space among the trees to make room in which to cultivate his crops, and it is a significant sign of that early condition of things that the coat-of-arms of one of our States bears the emblem of a sturdy yeoman with uplifted ax. Under such circumstances, it is no wonder that the people of this country in former time had no very favorable estimate of trees and little appreciation of their value, except for fuel and the supply of timber for house building and certain other uses, or that they were willing that their consumption by the ax should be aided and accelerated by forest fires. Comparatively few persons until a recent period realized the serious inroads which, with a rapidly increasing population, had been made upon our forest resources or apprehended the dangers which were threatening us in the future as the consequences thereof.

In Europe Mr. Marsh found the Governments of Italy and Germany, as well as those of other countries, making active endeavors and at great expense to rehabilitate their forests which had been depleted centuries before, to guard them from depredation and, instead of leaving them to be consumed at the bidding of personal greed or recklessness, cherishing them as among their most precious possessions. He found the forests regarded as the most valuable crop which the ground can produce, and every effort made to stimulate their growth to the utmost. He found schools, of a grade corresponding to our colleges, established for the special purpose of training men for the successful planting and cultivation of forests. He found the growth of trees in masses and their maintenance reduced to a science and the management of the woodlands constituting one of the most important departments of state.

Such discoveries were well calculated to fix his attention upon the very different condition of the forests in his own country, and to convince him that the reckless destruction of them then going on here, if not checked, would bring upon this land the same calamities which had befallen countries of the Old World in past centuries, and from which only the most enlightened nations of Europe are now recovering through the arduous efforts of many decades, and at great pecuniary cost. The result of Mr. Marsh's observations was the publication of a volume entitled "The Earth and Man," and that admirable chapter in it on "The woods," to which, more than to any other source perhaps, we are indebted for the awakening of attention here to our destructive treatment of the forests, and the necessity of adopting a different course if we would avert most serious consequences, threatening more than anything else, possibly, our material welfare.

Other thoughtful and observing men at home became aware from time to time that we were wasting our tree heritage, and in one way or another they were urging the necessity of caution and economy in the treatment of the forests. It is remarkable, indeed, that as early as the colonial period some of our States—New Hampshire and New York, for

example—became somewhat alarmed by the inroads which were even then being made upon their forests, and made enactments for their protection. This action was exceptional, however, and little was done to draw attention to the rapid and dangerous depletion of our forests and awaken public sentiment on the subject until within the comparatively recent period of which we have just spoken.

For the purpose of securing a supply of timber for naval construction the Government, at the beginning of the present century, purchased certain tracts of live-oak timber, and about twenty-five years later, by an act of Congress, the President was authorized to take measures for their preservation. About the same time the Massachusetts Society for Promoting Agriculture offered prizes for forest planting, and thirty years later the State ordered a survey of her timber lands. Thirty years later still, acts began to be passed for the encouragement of timber planting, chiefly in the treeless Western States. The well-known timber-culture act was one of these. It made a free gift of the public lands to the successful planter of forest trees on one-fourth of his entry.

About twenty years ago the subject of forest destruction and its detrimental results came before the American Association for the Advancement of Science for consideration, and as the result of its discussions the association memorialized Congress, asking that measures be taken for the protection of the public timber lands. In consequence of this, a committee of the House of Representatives was appointed for the purpose of considering the establishment of a forestry department of the Government, and two years later the Commissioner of Agriculture was authorized to appoint a forest commissioner, which was the foundation of the present Forestry Division in the Department of Agriculture. The commissioner, the late Dr. F. B. Hough, made protracted inquiries into the condition of the forests in this country and in Europe, and published a voluminous report on the subject, which is altogether the most complete and valuable publication on forestry which has appeared in this country.

It was at about this time, or a few years earlier, that a practical movement was inaugurated by the present Secretary of Agriculture, the Hon. J. Sterling Morton, which has done more for the protection of our forests and the encouragement of tree planting than all our legislation. This was the establishment of Arbor Day, or tree-planting day. It was the happy thought of this pioneer settler on the treeless plains of Nebraska, who knew and felt the value of trees about the home, as well as their importance for the many uses of life, to enlist his neighbors and his fellow settlers throughout the State, by a common impulse, growing out of common wants and feelings, in the work of tree planting on one and the same given day. The wise suggestion was brought before the State board of agriculture in the form of a resolution designating a certain day for the inauguration of the tree-planting movement. The resolution was readily adopted. The appeal to the popular feeling and

the popular need was heartily responded to, and it was reported that many millions of trees were planted that year in Nebraska. This successful inauguration of Arbor Day led to its institution the same year by the horticultural society in Iowa, to be followed quickly by its adoption in Minnesota, Ohio, and other Western States.

A few years later Arbor Day assumed a new character and acquired a wider interest with the people as it became connected in its observance with the public schools. This it did for the first time during the sessions of a national forestry convention at Cincinnati in the year 1882. The sessions of the convention were continued through five days, on one of which there was a public parade, civic and military, with a march to Eden Park, where groves were planted and single trees in memory of distinguished men—poets, orators, governors, and others. The school children and their teachers formed a conspicuous feature of the pageant and the planting of the trees was done principally by them. Tree planting thus became a festivity, combining at once pleasure and utility. That Cincinnati observance was an object lesson for the country, as the report of it was published far and wide.

A national forestry association was formed at the time of the Cincinnati convention, and at its meeting in St. Paul the following year a resolution was adopted favoring the observance of Arbor Day by the schools of the country. A standing committee on Arbor Day was also appointed, and such a committee has been appointed at nearly every annual meeting of the association. Wherever since then Arbor Day has been adopted its observance has been connected with the schools, as it has been also in the States where it had been established before. Thus it has become a school festival, as it has also become a national one. It was only what might have been expected, therefore, that at the meeting of the National Education Association, at Saratoga, in July, 1892, when the subject had been brought to its attention by the Hon. B. G. Northrop. the committee to whom it was referred should report as follows:

> Your committee reports with pleasure that Arbor Day is now observed in accordance with legislative act, or annual public proclamation, in forty States and Territories. We recommend that the observance be universal, that village and district improvement associations be formed, that memorial trees be planted, and that appropriate means be employed to inspire in pupils and parents the love of beauty and a desire for home and landscape adornment.

Arbor Day is educational in the best and largest sense. By engaging the pupils of the schools in the study of trees, not merely from books but by actual observation and handling of them in their living state, the observing faculties of the pupils are appealed to and cultivated, and their minds are easily led on from the study of trees to that of shrubs and flowering plants and all natural objects. There can be no better training than this. It forms one of the best equipments for success in life in whatever employments one may be engaged, and is a

never-failing source of enjoyment. No studies are more wholesome than those of natural objects. They are suggestive of only what is good. They cultivate the sense and love of the beautiful everywhere. They meliorate the nature within us and fit us to be associates with one another, and to become worthy members of society wherever we may be.

And so Arbor Day and its public observance, taken with the studies connected with it, has led on naturally to the formation of town and village improvement societies and various other associations and organizations for the promotion, in one way and another, of the public welfare. The spirit of Arbor Day is benevolent. Its aim is the public good in some form, and it has a wide outlook. There is nothing narrow or selfish about it. If it plants trees, it is not for the benefit of any individual alone, but for all who may see them and have the benefit of them, whether soon or centuries hence. It plants for those who are to come, as well as for those now living.

Arbor Day is the one festival or celebration which, instead of looking backward and glorifying the heroes and achievements of the past or recounting the praises of present enterprises or actors, looks forward and seeks to make a better environment and a better inheritance for the coming generations. Its spirit is hopeful. Its motto is progress. It is ever reaching out for new acquisitions of knowledge, and seeking to impart new and more widespread benefits.

It is not a matter for wonder, therefore, that an institution with such a spirit and such possibilities, with so much to commend it to the attention of persons of intelligence and generous feeling, and especially to the ardent natures of the young, should have a speedy and wide acceptance. And so, by its own manifest merit and without any propagandism on its behalf, it has been adopted by nearly every State and Territory of the Union; and limited by no national boundaries, it has even crossed the Atlantic on the one hand, and become established in Great Britain, France, and northern and southern Africa, and on the other, within the present year, has crossed the Pacific and been welcomed in the Hawaiian Islands and in Japan.

The beneficent results of an institution of this character, and already almost world-wide in its reach, no one can measure. Year by year it will bring millions of people, young and old, into a closer and more intimate contact with nature, unveiling to them its precious secrets, opening to them stores of valuable knowledge, and cultivating in them the best feelings. In our own country it promises to do more than anything else to convert us from a nation of wanton destroyers of our unparalleled heritage of trees to one of tree planters and protectors. Instead of looking upon the trees with indifference, or even with a hostile feeling, as to a great extent we have done, or regarding them chiefly as material for use in the constructive arts or to be consumed as fuel, we shall become tree lovers. A tree sentiment will be created and established which will lead us to recognize and cherish the trees as

friends, and while we shall freely make use of them in the various arts and industries of life, we shall be mindful of their value in other respects and find constant delight in their companionship.

To show the natural result of the establishment of Arbor Day and how it increases its hold upon the regard of a people from year to year as it becomes more and more familiar to them and its obvious lessons are learned by them, it is enough to adduce the history of Nebraska, in which the day originated—since the time it began to be celebrated there. Arbor Day originated in this manner: At an annual meeting of the Nebraska State board of agriculture held in the city of Lincoln, January 4, 1872, J. Sterling Morton, of Nebraska City, introduced the following resolution, which was unanimously adopted after some little debate as to the name, some of those present contending for the term "Sylvan" instead of "Arbor:"

Resolved, That Wednesday, the 10th day of April, 1872, be, and the same is hereby, especially set apart and consecrated for tree planting in the State of Nebraska, and the State board of agriculture hereby name it Arbor Day; and to urge upon the people of the State the vital importance of tree planting, hereby offer a special premium of one hundred dollars to the agricultural society of that county in Nebraska which shall, upon that day, plant properly the largest number of trees; and a farm library of twenty-five dollars' worth of books to that person who, on that day, shall plant properly, in Nebraska, the greatest number of trees.

The result was that over a million trees were planted in Nebraska on that first Arbor Day.

Three years later the day had attained such favor with the people that the governor, by public proclamation, set apart the third Wednesday of April as Arbor Day, and recommended that the people observe it as a day of tree planting. Annually thereafter other governors of the State followed this example, until at the session of the legislature in 1885 an act was passed designating the 22d day of April, the birthday of Mr. Morton, as the date of Arbor Day, and making it one of the legal holidays of the State.

As further showing the deep lodgment which Arbor Day has gained in the regard of the people of Nebraska, and the interest with which it is cherished by them, it is significant to notice that since the inauguration of Arbor Day a provision has been embodied in the constitution of the State which recites, "That the increased value of lands by reason of live fences, fruit, and forest trees grown and cultivated thereon shall not be taken into account in the assessment thereof."

The following statutory enactments are now in existence also:

SEC. 3. That the corporate authorities of cities and villages of the State of Nebraska shall cause shade trees to be planted along the streets thereof.

SEC. 4. For the above purpose a tax of not less than one dollar nor more than five dollars, in addition to all other taxes, shall be levied upon each lot adjacent to which the trees are to be planted as aforesaid, and collected as other taxes.

SEC. 5. Trees shall be annually planted, when practicable, on each side of one-fourth of the streets in each city and village in the State of Nebraska, until all shall have shade trees along them not more than twenty feet apart.

SEC. 6. The corporate authorities aforesaid shall provide by ordinance the distance from the side of the street that trees shall be planted, and the size thereof.

SEC. 7. *Provided,* The owner of any lot or lots may plant trees adjacent thereto where ordered as above, in the manner and of the size prescribed, and on making proof thereof by affidavit to the collector, said affidavit shall exempt said owner from the payment of the aforesaid tax.

SEC. 8. Any person who shall materially injure or shall destroy the shade tree or trees of another, or permit his animals to destroy them, shall be liable to a fine of not less than five dollars, nor more than fifty dollars for each tree thus injured or destroyed, which fine shall be collected on complaint of any person or persons before any court of proper jurisdiction. One-half of all fines thus collected shall be paid to the owner of the trees injured or destroyed; the other half shall be paid into the school fund.

SEC. 9. That this act shall not apply to any person that is occupant of any business lot without his consent.

SEC. 10. That when any person shall plant and properly cultivate for the term of five years, six rows of trees, eight feet apart, and the trees four feet apart in the row along either the north section or the half section line, running east and west, said rows to be not nearer to the said north section or half section line than four feet or to the south line of any road which may be laid out on said north section or half section line; or when any person shall fill out to the standard above prescribed, and keep the same in a proper state of cultivation for the time above stated, any rows of trees that may have previously been planted along said north section or half section line, it shall be the duty of the county commissioners to pay such person, by warrant on the county treasurer, a sum of money, amounting to three dollars and thirty-three cents per acre, for each acre so planted and cultivated annually, so long as the same is planted and kept growing and in a proper state of cultivation, for a period not to exceed the space of five years, and to an extent not to exceed three acres of land.

SEC. 11. It shall be the duty of the assessor of each precinct to make proper examination and report to the county commissioners, at the time of his annual report, the condition of all timber so planted and cultivated under the provisions of this act.

How firmly the tree-planting idea has taken hold of the people of Nebraska is further shown by a joint resolution adopted by the last legislature, and approved April 4, 1895:

Whereas the State of Nebraska has heretofore, in a popular sense, been designated by names not in harmony with its history, industry, or ambition; and

Whereas the State of Nebraska is preeminently a tree-planting State; and

Whereas numerous worthy and honorable State organizations have, by resolution, designated Nebraska as the "Tree Planter's State;" Therefore, be it

Resolved by the legislature of the State of Nebraska, That Nebraska shall hereafter, in a popular sense, be known and referred to as the "Tree Planter's State."

To this may be added, not inappropriately, another joint resolution adopted at the same session, which is an outgrowth of the same sentiment as that which led to the adoption of the popular name, "Tree Planter's State."

Whereas, the adoption of a State floral emblem by the authority of the legislature would foster a feeling of pride in our State and stimulate an interest in the history and traditions of the Commonwealth: Therefore, be it

Resolved, That, the Senate concurring, we, the legislature of Nebraska, hereby declare the flower commonly known as the "Golden Rod" (*Solidago serotina*) to be the floral emblem of the State.

Approved April 4, A. D. 1895.

The Hon. Henry R. Corbett, State superintendent of public instruction, says:

> The effect of Arbor Day it will be impossible to estimate in figures or statistics. It has resulted in stimulating a pride in the resources of Nebraska and a sentiment in favor of extending and preserving our forest areas. It is observed and talked about in every school room, and through its influence millions of trees have been planted and cared for annually throughout the State.

To these testimonies may be added the following recent statement of the Hon. R. W. Furnas, who, as governor of Nebraska, issued the first Arbor Day proclamation and who has watched with interest the progress and results of the day's observance ever since:

> No observance ever sprang into existence so rapidly, favorably, permanently, and now so near universally throughout the whole civilized world as that of "Arbor Day." It originated less than a quarter of a century since, and has been adopted, in some form or other, in all the States and Territories of this Union, and in nearly all foreign civilized countries, increasing in popularity wherever known.
>
> The words "Arbor Day" are attractive to the eye—to read in print and to meditate; they are rythmical to utter and to the ear. The word "Arbor" carries with it most pleasant remembrances to the young and promise to the older—"a bower, a seat shaded by trees." What more enticing and enchanting to refined æsthetic taste and mind than such retreat, such rest, shelter, protection? This characteristic alone makes it worthy of a permanent place in our civilization.
>
> Its economic worth, because of its usefulness among all classes of people, commends it with equal force.
>
> Its origin was prompted by a desire to ward off the rigorous winds of northwestern prairies, and to supply fuel as well. Its accomplishments in this respect are already beyond pecuniary computation. Through the instrumentality of its observance in Nebraska many thousands of acres hitherto bleak, worthless, undesirable prairie lands have been clad with millions of trees, thus converting them into valued forest groves, fruitful orchards, prosperous homes, with happy people as occupants. A great commonwealth has been built on the foundation "Arbor Day," and within the recollection of those who participated in "laying the corner stone."
>
> The influence of tree planting on the western prairies, influencing climate conditions for good, is found to be next to incalculable—retaining moisture and breaking the force of sweeping winds. Growing out of this climatic revolution is the greater result of increased crop products.
>
> Records show the number of trees planted in Nebraska since the inauguration of "Arbor Day" running into billions. Instances are also of record, where the earlier planted and more rapid growing varieties of trees which were used have been already converted into sawed lumber, of which residences and other buildings have been constructed.

It has been deemed proper to present in this extended manner an account of the inauguration, establishment, and progress of the Arbor Day institution in Nebraska as an illustration not only of what the observance of the day has effected in a particular State, but of what it is effecting in many other States and may be expected to do wherever it is established.

To show that similar results have followed the introduction of Arbor Day in other States, it will be enough to cite briefly the testimony of a few superintendents of public instruction, persons who possess the best means of information upon the subject.

Superintendent Sabin, of Iowa, well known for the great interest he has taken in the proper observance of Arbor Day, says:

Arbor Day has been regularly observed in Iowa since it was instituted in 1887. It is the custom of this department to issue an Arbor Day annual for free distribution. Special care is taken that one reaches every school in the State.

Although there is no legal requirement, the day is very generally observed by the schools, and in many cases by citizens. It is proper to say here that our school law requires every board of directors to set out and properly care for at least twelve shade trees on each school grounds not already provided with suitable shade.

The influence of such an observance is very excellent, although, as in other good work, perseverance is necessary to success. We intend to continue the custom from year to year.

The superintendent of public instruction in Wyoming says:

The day is observed by the planting of trees and appropriate exercises in each department of our schools.

A great degree of interest is manifested by the children and people generally and seems to be increasing. Pupils look forward with great pleasure to the planting and naming of their trees. In a great many schools each child contributes toward the buying of a tree, and in after years watches its growth very carefully.

Particular interest, I think, is shown in this day in Wyoming for the reason that we have so few native trees and it requires so much care to cultivate them.

E. B. Prettyman, secretary of the Maryland board of education, says:

The day is observed universally by the public schools of the State. Great interest is manifested, which I believe to be increasing. I believe the effect of the observance of Arbor Day is very beneficial in cultivating a love for trees and for the adornment not only of school lots with trees, vines, and flowers, but that this cultivation extends to the families and homes represented in the schools.

Hon. J. M. Carlisle, superintendent of public instruction in Texas, says:

Washington's birthday, February 22, is observed in this State as Arbor Day. It is observed as a holiday, and is devoted to the planting of trees, shrubs, flowers, and the general ornamentation of public buildings and grounds. The patriotic exercises appropriate to Washington's birthday blend beautifully with the observance of Arbor Day.

The effect of the observance of the day is wholesome. Interest in the study of trees, shrubs, and flowers is stimulated, appreciation of the wonders and beauties of nature is heightened, and the sentiment in favor of both physical and moral cleanliness is greatly strengthened, while patriotic feelings are aroused and the people are drawn together by the contemplation of so many great themes in which all have a common interest.

The superintendent of public instruction in North Dakota says:

The degree of interest in the observance of the day is increasing, and the effect upon pupils of the schools and the public generally is gratifying in the same degree which marks the increasing observance of the day.

Hon. A. B. Poland, State superintendent of public instruction in New Jersey, says:

Ever since the adoption of the act for the observance of Arbor Day (1884) the observance has been universal throughout the State, and, in general, eminently satisfactory. I am of the opinion that, after eleven years' experience, the interest taken in the observance of Arbor Day has in no respect diminished. This would be a remarkable phenomenon were it not that the end subserved were generally recognized to be a useful one.

I am of the opinion also that the participation of the schools and, to a considerable extent, the citizens in the observance of Arbor Day has resulted in a moral and æsthetic improvement that may be clearly discerned.

New York was late in adopting Arbor Day by legal provision, though the day had been more or less observed for several years; but no State, since the enactment of the "act to encourage arboriculture" (1888), has been more active or efficient in the observance of Arbor Day. Hon. Charles R. Skinner, State superintendent of public instruction, speaking of the passage of the act, says:

Without doubt one of the effects of this legislation has been to arouse a deeper interest in trees and flowers among pupils and people. We hear more in these days concerning the preservation of our forests than before the enactment of the law. Our school grounds are kept in better condition and the trees about our schoolhouses are better protected. In thousands of cases trees so planted on Arbor Day have been named for men and women prominent in education and in our history generally.

The manuals which have been issued by the department of public instruction from year to year, and the larger and very noteworthy manual compiled by Mr. Skinner himself, testify abundantly to the vigor with which the Arbor-Day propaganda has been promoted in New York. Those manuals have been freely drawn upon in the preparation of the present publication.

The number of trees planted in New York on Arbor Day is officially stated by Mr. Skinner as follows: 1889, 24,166; 1890, 27,130; 1891, 25,786; 1892, 20,622; 1893, 15,973; 1894, 16,624.

STATES AND TERRITORIES OBSERVING ARBOR DAY.

States.	Year of first observance.	Time of observance.
Alabama	1887	22d of February.
Arizona	1890–91	First Friday after 1st of February.
Arkansas		
California	1886	
Colorado	1885	Third Friday in April.
Connecticut	1887	In spring, at appointment of governor.
Florida	1886	January 8.
Georgia	1887	First Friday in December.
Idaho	1886	Last Monday in April.
Illinois	1888	Date fixed by governor and superintendent of public instruction.
Indiana	1884	Date fixed by superintendent of public instruction.
Iowa	1887	Do.
Kansas	1875	Option of governor, usually in April.
Kentucky	1886	Do.
Louisiana	1888–89	Option of parish boards.
Maine	1887	Option of governor.
Maryland	1889	Option of governor, in April.
Massachusetts	1886	Last Saturday in April.
Michigan	1885	Option of governor.
Minnesota	1876	Do.
Mississippi	1892	Option of board of education.
Missouri	1886	First Friday after first Tuesday of April.
Montana	1887	Third Tuesday of April.
Nebraska	1872	22d of April.
Nevada	1887	Option of governor.
New Hampshire	1886	Do.

STATES AND TERRITORIES OBSERVING ARBOR DAY—Continued.

States.	Year of first observance.	Time of observance.
New Jersey	1884	Option of governor, in April.
New Mexico	1890	Second Friday in March.
New York	1889	First Friday after May 1.
North Carolina	1893	
North Dakota	1884	6th of May, by proclamation of governor.
Ohio	1882	In April, by proclamation of governor.
Oklahoma	....	
Oregon	1889	Second Friday in April.
Pennsylvania	1887	Option of governor.
Rhode Island	1887	Do.
South Carolina	Uncertain.	Variable.
South Dakota	1884	Option of governor.
Tennessee	1875	November, at designation of county superintendents.
Texas	1890	22d of February.
Vermont	1885	Option of governor.
Virginia	1892	
West Virginia	1883	Fall and spring, at designation of superintendent of schools.
Wisconsin	1889	Option of governor.
Wyoming	1888	Do.
Washington	1892	Do.

Only the following three States or Territories fail to observe Arbor Day: Delaware, Indian Territory, and Utah. In Delaware the day is observed in some localities, and the same is probably true in Utah and the Indian Territory.

ARBOR DAY CELEBRATIONS.

While the object of Arbor Day, as originally instituted, was to secure the planting of trees on a large scale and for economic purposes, in a region nearly destitute of trees and where the need of them for fuel as well as for shelter was strongly felt, now that its observance has spread all over the country and has become almost universally connected with the schools, nowhere is the day welcomed with more of zest and enjoyment than in those parts of the country where trees are most abundant.

The value of Arbor Day observances in connection with our schools, therefore, is not to be measured so much by the number of trees planted at a given time as by the tree spirit implanted in those engaged in the observance, by the knowledge of tree life incidentally gained, and the feelings and principles engendered or promoted and their after influence upon life and character. The value of Arbor Day is not so much in its present enjoyments for a day as in what it does by preparing our growing youth to be useful and happy men and women when they reach the position of influence and responsibility, when the duties of public and social life and the molding and direction of social and political affairs are to be transferred from those who now control them and are to be assumed by themselves.

It is much in favor of the day and its appropriate observance that it may afford such opportunities for bringing the young so pleasantly into contact with Nature, and opening their minds in their most impressible time to her healthy and happy influences. It is good to take the pupils out of the schoolroom for a day into the open air, into Nature's school place. And it would be a good thing if they could be taken into the fields and groves, under the judicious guidance of their teachers, not only once a year, but oftener. An occasional half-holiday thus taken would be of more real benefit, more instructive, than any equal portion of time spent in the schoolroom. It would be taking the children to the original fountains of knowledge, where they would gain it at first and not at second hand. Fresh flowers are better than those of the herbarium. It would give scope and stimulus to their observing faculties, the first to open and the first which offer themselves to be trained for proper use, on whose proper use also the success and happiness of after life chiefly depend. As Wordsworth says:

> Nature never did betray
> The heart that loved her; 'tis her privilege,
> Through all the years of this our life, to lead
> From joy to joy; for she can so inform
> The mind that is within us, so impress
> With quietness and beauty, and so feed
> With lofty thoughts, that neither evil tongues,
> Rash judgments, nor the sneers of selfish men,
> Nor greetings where no kindness is, nor all
> The dreary intercourse of daily life
> Shall e'er prevail against us, or disturb
> Our cheerful faith that all which we behold
> Is full of blessing.

It had been a thousand times better for some if, instead of moiling over books in the schoolroom, they had been allowed to spend more of their younger days in the open world, the school of Nature, to be companions of the birds, listening to their songs and learning their habits, strolling along the brooks, following their windings through wood and meadow, and coming home laden with the treasures which Nature is ever ready to bestow upon the youngest child or the oldest man who has an eye to see and a heart to feel their beauty.

Happily, the methods of the schoolroom are better than they were, though there is still room for improvement. Nature studies have found some place in them. But these would be made more interesting and more effective if teacher and pupils together were oftener to get face to face with Nature herself, the great teacher.

METHODS OF OBSERVING ARBOR DAY.

The observance of Arbor Day may be as various in method as the tastes and inclinations of those engaged in it. Much will depend upon the teacher; much, also, upon the character of the school and the age and previous training of the pupils. If the teacher has a moderate share of inventiveness there will be little difficulty. The chief thing

is to have the pupils interested in what they do, and if they are taken into confidence by the teacher and invited to offer suggestions, they will often make a plan so sensible and satisfactory as almost to relieve the teacher from any burden of care in regard to it.

Of course it is presumed that the pupils are, to some extent, prepared beforehand for the celebration of Arbor Day by having it spoken of by the teacher and its objects explained, and that there has been more or less talk on the part of the teacher and readings about trees and plants and some familiarity with them and with the elements, at least, of vegetable physiology. It is supposed also that the history and character of distinguished persons in honor of whom it is proposed to plant trees will have been studied.

As the time of celebration draws nigh, therefore, let there be a conference between teacher and pupils as to the method to be adopted. First, as to the tree planting. Where is it to be—on the school ground or on some highway, or in some park? Is it to be done by the school or schools alone, or in cooperation with a larger general movement of the inhabitants of the place for the improvement of its appearance by a systematic planting of trees on the streets and elsewhere? How many trees will the school undertake to plant? What kinds of trees will they plant? The decision of the last question will depend upon where the planting is to take place and whether it is to be done by the school alone or in concert with others. If the planting is to be upon the school premises, it may be desirable to plant different trees from those which might be selected for the street or the park. If the planting is to be done in concert with others, a village improvement society for instance, then the choice of trees will properly be left to such society.

But these preliminary questions having been decided, in order that all may go smoothly on Arbor Day, and to provide against the impediments of unfavorable weather at that time, it is desirable to have a committee of the older pupils appointed to see that the designated trees are procured beforehand, and that holes are properly prepared for their reception, so that there may be no unnecessary delay at the time of planting.

These arrangements having been made, it remains to be decided with what ceremonies or exercises the tree planting shall be accompanied. The programme in this respect will be more or less elaborate according to the age of the pupils, the customs of the place, and the extent to which the Arbor Day spirit has been already developed. But let it be remembered that this is eminently the children's day, and that we all like ceremonies, on special occasions at least. And if the grown-up man needs drum and fife, epaulets and plumes and banners, and the measured march and countermarch to make his soldiering satisfactory, the children may well be invited on Arbor Day to march along the streets to the music of their own familiar songs, wearing such scarfs and badges as they choose to decorate themselves with, and carrying aloft their banners with the pride of young patriots and scholars.

It will be well for the pupils to assemble with their teachers at the schoolroom in the morning and spend a portion of the day—parents and friends being present also—in listening to addresses from any who may have been invited beforehand to speak to them. Essays may also be read by the older pupils. These may be interspersed with songs and recitations and familiar talks about trees and plants. Later in the day, in the afternoon, perhaps, the planting of the trees will take place, songs, addresses, and recitations accompanying the planting of each tree. The character of the weather will determine how much of the exercises shall take place in the open air and how much in the schoolroom or elsewhere. It is the custom in some places, and a very good custom it is, for all the schools to come together at some central place, after the planting is finished, and for the older people, who have been engaged in tree planting, to meet with them and all report what they have done, and end the day with an hour or two around a well-spread table, and with music, songs, and perhaps pleasant games.

ADDRESSES AND EXTRACTS.

The following address by Hon. J. Sterling Morton, delivered April 22, 1887, at the State University, Lincoln, Nebr., has a fitting place in a manual of Arbor Day:

ARBOR DAY: ITS ORIGIN AND GROWTH.

LADIES AND GENTLEMEN: Just as stars in the sky brighten all the firmament with light, so holidays and anniversaries commemorate exalted characters, recall noble deeds, and perpetuate pure principles, illumine the arena of human life, and light up the higher pathways for manly effort and ambition.

Ordinary holidays are retrospective. They honor something good and great which has been, and, by its exaltation, commend it to the emulation of mankind. Thus the past is made to inspire the present, and the present to reach into and influence the immeasurable and unknowable future.

But "Arbor Day"—Nebraska's own home-invented and home-instituted anniversary—which has been already transplanted to nearly every State in the American Union, and even adopted in foreign lands, is not like other holidays. Each of those reposes upon the past, while Arbor Day proposes for the future. It contemplates, not the good and the beautiful of past generations, but it sketches, outlines, establishes the useful and the beautiful for the ages yet to come. Other anniversaries stand with their backs to the future, peering into and worshipping the past; but Arbor Day faces the future with an affectionate solicitude, regarding it as an artist his canvas, and etches upon our prairies and plains gigantic groves and towering forests of waving trees, which shall for our posterity become consummate living pictures, compared to which the gorgeous colorings of Rubens are tame and insignificant.

The wooded landscape in sunlight and in shadow, which you—in the trees you have planted to-day—have only faintly limned, shall in the future fruition of their summer beauty compel the admiration and gratitude of men and women now unborn,

who shall see with interest and satisfaction their symmetry and loveliness. As one friend hands to another a bouquet, so this anniversary sends greetings and flowers, foliage and fruit, to posterity. It is the sole holiday of the human family which looks forward and not backward.

Arbor Day originated in Lincoln on January 4, 1872. Upon that day the festival was instituted by a resolution of the Nebraska State board of agriculture. It was my good fortune to have thought out this plan for popularizing arboriculture and to have originated the term or phrase "Arbor Day" and to have written, submitted, and advocated that resolution, and thus to have established this anniversary. It will grow in popular esteem from year to year, until finally it shall be observed universally throughout the Union of American States.

It has become the scholastic festival of our times. Common schools, colleges, and universities have taken its practical observance under their own special and intelligent direction. The zeal of youth and the cultured love of the beautiful combine to perpetuate and to popularize it.

That which should survive in America must harmonize with education and refinement. Whatsoever the schools, the teachers, and the pupils shall foster and encourage, shall live and flourish, mentally and morally, forever. Students, scholars, and philosophers have ever been associated with trees and their conservation. The Academeia of Athens where Socrates and Plato taught was only a grove of plane trees. There rhetoric, logic, and philosophy were given to the youth of Greece by those majestic men, whose great thoughts more than two thousand years after their death are still vitalizing and energizing the world of mind. The plane tree that Agamemnon planted at Delphos; the one grown by Menelaus, the husband of Helen of Troy; and that one which so charmed Xerxes with its surpassless beauty, when invading Greece with his great army, that he remained one entire day wrapped in its admiration, encircling it with a gold band, decking it with precious jewels, having its figure stamped upon a golden medal, and by his delay losing his subsequent battle with the Greeks—these are all historic trees and yet strangers almost to the average reader.

But the beautiful avenues and tranquil shades of the grand plane tree, which adorned the Academeia of Athens, are familiar to every student. The voice of Socrates mingled with the music of their waving boughs and Plato mused beneath their far-extending shadows. Thus the first fruits of philosophy are borne to us with the fact that Grecian civilization was a tree-planting civilization. And the transmitted wisdom of those ages illustrates how marvelously trees and learning have always been intimately associated together.

Upon the inner bark, called "liber," of trees came the annals, the lore of all the ancient world's written life inscribed by the stylus. Not only from tree bark has the intellect of man taken the record of its early development, but even the word "library," which embraces all the conserved thoughts of all the thinking ages, comes from the inner bark of a tree. And the word "book," take either derivation you choose, comes from one in German or Saxon or Scandinavian, meaning beech wood, because in the dawn of learning all records were written on beech boards, and the leaf and the folio which make up the book came to us also from the trees.

But leaving ancient times, ceasing to trace tree ancestry from words, and reluctantly remaining silent as to many delightful delusions concerning the sacred groves of Greece and Rome and their storied genii, who gave wisdom to sages and judgment to lawmakers, and skipping likewise all the tree lore and tree metaphor in the Bible—and that is indeed self-denial on an occasion like this—let us see how forests and our English ancestry are indissolubly connected, and how, by the very law of heredity, we should all become amateur foresters.

The Druids first planted forests and groves in England. In the misty twilight between barbarism and civilization the teachers and students of Great Britain were Druids. All their discourses and ceremonies transpired in the oaken groves and

sacred orchards of their own planting, and Pliny declares the word "Druid" to have come from the Greek word *drus*—an oak. And while no Druid oaks now remain, there are still in England many very venerable trees. Among them are the Damory oak, of Dorsetshire, 2,000 years of age; Owen Glendower's oak at Shelton, near Shrewsbury, from the branches of which that chieftain looked down upon the battle between Henry IV and Henry Percy in 1403. The great oak of Magdalen College, Oxford, was a sturdy sapling when nine hundred years ago Alfred the Great founded that institution of learning. It received injuries during the reign of Charles I which at the close of the last century caused its decay and death.

Windsor Forest is notable also for its majestic oaks of great age, one of them known to have withstood more than a thousand years of winter and summer storms. Not many decades have passed since Herne's oak, which had borne that hunter's name from the reign of Elizabeth, was blown down. In the Merry Wives of Windsor, Shakespeare has told its story. Elizabeth, who was first saluted at Hatfield as "the Queen of England," in the shade of the towering trees of oak which line its broadest avenues, greatly encouraged agriculture, and was among the first English-speaking advocates of forestry.

When Columbus was seeking a new world, his crew, anxious and incredulous, even unto mutiny, the waves bore out to his ship twigs and foliage from the forests of the unknown land, giving him hope, faith, victory even, as the dove with the olive branch had carried God's peace to Noah centuries before.

Nearly two hundred years after Columbus came the Puritans, and then began the war upon the woodlands of America. Since then, ax in hand, the race has advanced from the Atlantic Seaboard westward for more than two centuries, devastating forests with most unreasoning energy, always cutting them down, and never replanting them. Hewing their way through the Eastern and Middle States, the pioneers have wantonly destroyed without thought of their posterity millions upon millions of acres of primeval woodlands.

Cleaving right and left through Ohio, Michigan, and Indiana, felling giant trees, rolling them into log heaps and destroying them by fire, emigration emerged upon the treeless plains of Illinois and the Northwest.

Nature teaches by antithesis. When sick we learn to value health; when blind we realize the beneficence, the surprising and delicious sense of sight; when deaf we dream of the music we loved to hear, and melodies forever dead to the ear float through the mind that is insulated from sound like sweet memories of the loved and lost. So these treeless plains, stretching from Lake Michigan to the Rocky Mountains, were unfolded to the vision of the pioneer as a great lesson to teach him, by contrast with the grand forests whence he had just emerged, the indispensability of woodlands and their economical use. Almost rainless, only habitable by bringing forest products from other lands, these prairies, by object teaching, inculcated tree planting as a necessity and the conservation of the few fire-scarred forests along their streams as an individual and public duty. Hence out of our physical environments have grown this anniversary and the intelligent zeal of Nebraskans in establishing woodlands where they found only the monotony of plain, until to-day this State stands foremost in practical forestry among all the members of the American Union.

An arboretum is to tree culture what a university is to mental life. The skilled forester gathers in the former all varieties of trees, studies the habits and requirements of each, and stimulates growth and defines forms by all the appliances of his art. In the universities are collected human intellects of all types and all degrees of strength and quickness. Here, as among the trees, are all the inexorable and ineffaceable results of the operations of the law of heredity. Here, as in the arboretum, we are taught that though nurture may do much, nature does most.

The cottonwood can never become an oak, but it can pass the oak in the race for maturity. It can even aid the oak to become more stately in form, to grow straighter

and taller than when left to itself, without the competition of more swiftly shooting trees. A row of acorns planted between two lines of infant cottonwoods will come up and make an effort to reach sunlight, up beyond the shadows of their soft-wood competitors, which oaks never make when planted by themselves. Thus in the arboretum the less is made to act as a nurse and guardian to the more valuable timber. At Arbor Lodge some years since, in 1865, I planted a long row of black walnuts between two ranks of swiftly growing soft-wood trees—maple on one side and cottonwood on the other. During these twenty years I have watched the walnuts growing symmetrically and beautifully to great height, in their struggle to reach the light up and beyond the shade of their less valuable contemporaries and co-tenants. They are higher, better trees than they would have been without the rivalry of their neighbors—their classmates.

So mind by contact with mind and struggle of brain with brain is improved. The mediocrity of one is almost obliterated by contests with the superiority of another. Just as trees seek—must have—sunlight, just as they reach up into the sky for it out from shade, so the mind in competitive seeking after knowledge ever exalts itself, perfects and embellishes itself. A dull brain developing in solitude is dwarfed and gnarled like a lone oak on the prairie; but associated with the sharp, quick perceptions of its superiors, it becomes a better brain, and bestows benefits upon mankind where in solitude it would have withered into fruitlessness. The wonderful similitudes between tree life and human life are almost innumerable. They have been recognized in all ages, and man's metaphors for all that is beautiful, useful, desirable, and immortal have been, since written language began, largely drawn from sylvan life. The "Tree of Knowledge," the "Tree of Liberty," the "Tree of Everlasting Life" have been planted in all poesy; they have bloomed in all literature from the remotest of historic times. Books not drawing simile, metaphor, or other figure of speech from tree life have been rare indeed. But the most beautiful tree, with its sheltering arms and its many-voiced foliage singing in the breeze, dancing in the sunbeams, and motioning to its own reflections on the greensward mirror below, with all its lustrous burden of fruit or flowers shimmering in the light, has a lower life invisible to us. Deep in the dark, damp earth its rootlets are groveling for existence—seeking here and there all manner of rottenness and feeding thereon with gluttonous avidity. Up in the clouds, gilded with sunshine, resplendent with coloring, nods the stately head; but down in the darkness and dirt are its supporters.

And as trees thus lead a dual life, an upper and a lower, so does man. The intellect, the reason, bathes in the light of knowledge. It scales the height of the firmament and reads the story of the stars. It descends into the profoundest depths of the sea and wrenches the secrets of creation from the rocks and shoals. Beautiful, symmetrical, flashing, and entrancing as a grand oak in autumn when crowned with gorgeous gold and crimson and purple leaves is the sturdy mind of a mature man, who, in temperance and tranquillity, has during a useful life grown strong in knowledge, in truth, fidelity, and honor.

Man's intellectual life must dominate. His lower life must be subservient. His mentality, like the tree top with its foliage, flowers, and luscious fruit, alone bestows the blessings. That is man's higher life, and where it governs, man is man as nature meant man to be. The small trees of to-day's planting will develop into the groves and forests of the future. They will contribute the materials for ships, railroads, business edifices, and homes, to be used by those who are born in coming centuries.

The almost infinite possibilities of a tree germ came to my mind last summer when, traveling in a railway carriage amid the beautifully cultivated fields of Belgium, a cotton wood seed on its wings of down drifted into my compartment. It came like a materialized whisper from home. Catching it in my hand I forgot the present and wandered into the past to a floating mote like that, which had years and years before been planted by the winds and currents on the banks of the Missouri. That mote had taken life and root and growing to splendid proportions until in 1854 the

ax of the pioneers had vanquished it, and the saw, seizing it with relentless, whirling teeth, had reduced it to lumber. From its treehood evolved a human habitation, a home—my home—wherein a mother's love had blossomed and fruited with a sweetness surpassing the loveliness of the rose and the honeysuckle. Thus from that former feathery floater in mid-air grew a home and all the endearing contentment and infinite satisfaction which that blessed Anglo-Saxon word conveys—that one word which means all that is worth living for and for which alone all good men and women are living.

Here are a few acorns to-day; to-morrow, a century hence, they are sturdy oaks, then ships, railroads, carriages, and everything useful, and parts of homes which are all—in both poetry and reality—that is lovable, beautiful, and supremely tender in the career of humanity from birth to death. The real of to-day was the ideal of yesterday; the ideal of to-day will be the real of to-morrow.

And as arboretums are developing the infant forests, nursing tremendous timbers, whence masts and spars and sills and joists shall emerge into swiftly sailing ships and massive marts of trade, which are to convey and cover the commerce of coming times, so in the schools, the colleges, and universities are growing the mental timber whence the State shall cull in the near future those pillars and supports which aid to bear up forever in America civil and religious liberty; that is, freedom to think, freedom to speak, freedom to trade, freedom to develop individualism, and to assert its consciousness of right without fear either of sectarian or partisan bigotry. Let us all, then, each in his vocation and sphere, plant wisely for the years to come, rather than dwell dejectedly upon the years gone and going—the farmer, his forest and orchard, the teacher his science and morals. Improved materially by the former, intellectually by the latter, the world will well with gratitude to both. But tree planter and teacher united in one shall be declared the best benefactor of modern times—the chief provider for posterity.

Benedict & Co., Chi.

On the 10th day of July, 1886, from the crowded, hurrying streets of London I loitered into the solemn aisles of St. Paul's Cathedral. Around on every side were the statues of England's heroes. Upon tablets of brass and marble were inscribed their eulogiums. In fierce warfare on wave and field they had exalted English

courage and won renown for England's arms. Nelson and Wellington, victors by sea and land, were there, and hundreds more whose epitaphs were written in blood which, as it poured from ghastly wounds, had borne other mortals to the unknown world. Few men who won distinction in civil life are entombed at St. Paul's, but among them is the gifted architect, Sir Christopher Wren, in whose brain the concept of St. Paul's Cathedral had a mental existence before it materialized in massive marble. His epitaph is plain, brief, truthful, impressive; it is one which each honorable man in all the world may humbly strive for and become the better for the striving; it is one which every faithful disciple of horticulture, of forestry, will deserve from his friends, his family, and his country; vast orchards which he has planted and the great arms of towering elms, spreading their soothing shade like a benediction over the weary wayfarer who rests at their feet, and all the fluttering foliage whispering to the wanton winds shall tell the story of his benefaction to humanity, arborphoning that epitaph with perennial fidelity, "Si quæris monumentum, circumspice"—If you seek my monument, look around you.

Appropriately following the address of Mr. Morton, some extracts from an address of the Hon. B. G. Northrop, on Arbor Day, before the Massachusetts Horticultural Society, have place here:

OBSERVANCE OF ARBOR DAY BY SCHOOLS.

In this grand work initiated by Governor Morton [J. Sterling Morton], its application to schools was not named. The great problem then was to meet the urgent needs of vast treeless prairies. At the meeting of the American Forestry Association, held at St. Paul, Minn., in August, 1883, a resolution which I offered in favor of observing Arbor Day in schools in all our States and in the provinces of the Dominion of Canada (the association being international) was adopted, and a committee to push that work was appointed. Continued as their chairman from that day to this, I have presented the claims of Arbor Day personally or by letter to the governor or State school superintendent in all our States and Territories. My first efforts were not encouraging. By men in high positions Arbor Day was deemed an obtrusive innovation. It was no surprise to me when my paper on "Arbor Day in Schools," read at the National Educational Association (department of superintendence) at Washington, in February, 1884, called out the comment, "This subject is out of place here." Though that paper was printed by the United States Bureau of Education, it was a grateful surprise that the next meeting of the National Educational Association, held in August of the same year, at Madison, Wis., with an unprecedentedly large attendance, unanimously adopted my resolution in favor of Arbor Day in schools in all our States.

The logic of events has answered objections. Wherever it has been fairly tried, it has stood the test of experience. Now such a day is observed in forty States and Territories in accordance with legislative act, or by special recommendation of the governor or State school superintendent, or the State grange, or the State horticultural and agricultural societies, and in some States, as in Connecticut, by all these combined. It has already become the most interesting, widely observed, and useful of school holidays.

Arbor Day has fostered love of country. Now that the national flag with its forty-four stars floats over all the schoolhouses in so many States, patriotism is effectively combined with the Arbor Day addresses, recitations, and songs. Among the latter, the "Star Spangled Banner" and "America" usually find a place. Who can estimate the educating influence already exerted upon the myriads of youth who have participated in these exercises?

To the teaching of forestry in schools, it is objected that the course of study is already overcrowded—and this is true. But I have long urged that trees and tree life and culture form a fit subject for the oral lessons now common in all our best schools. When agent of the board of education of Massachusetts I sometimes took to the schools and institutes a collection of our common woods, as an object lesson, one of many aids in observation, discriminating wood by the grain. The same plan was occasionally tried in Connecticut, and with good results. To give one of many illustrations: A citizen of Norfolk, Conn., offered eighteen volumes of Appleton's Science Primers to any pupil who should gather and arrange the largest and best collection of the different kinds of wood, shrub, or vine growing in that town. Great interest was awakened, and 135 varieties were gathered by all the competitors, of which the collection of Washington Beach (who won the prize) numbered 125. What a discipline in quickness and accuracy of perception those schoolboys gained while exploring the fields, hills, and mountains of this large town, and discriminating all these varieties by the grain or bark! With no interruption of studies, there was a quickened zest and vigor for school work, and, best of all, that rare and priceless attainment, a trained eye. * * *

Those talks on trees, which Superintendent Peaslee says "were the most profitable lessons the pupils of Cincinnati ever had in a single day," occupied only the morning of Arbor Day, the afternoon being given to the practical work. Since 1883 our schools have rendered new service to the State as well as to their pupils by leading them to study the habits of trees, and appreciate their value and beauty—thus tending to make practical horticulturists and arborists. How many of these children in maturer years will learn from happy experience that trees, like grateful children, bring rich filial returns, and compensate a thousand fold for all the care they cost. George William Curtis says, "Arbor Day will make the country visibly more beautiful year by year. Every school district will contribute to the good work. The schoolhouse will gradually become an ornament of the village and the children will be put in the way of living upon more friendly and intelligent terms with the bountiful nature which is so friendly to us."

Kindred in sentiment with the address of Secretary Morton and the remarks of Dr. Northrop are the following words of Dr. E. E. Higbee, the late distinguished State superintendent of public instruction of Pennsylvania:

ARBOR DAY FOR THE COMMONWEALTH.

Recognizing the peculiar fitness of the executive proclamation fixing an Arbor Day for the Commonwealth, it has been our effort and pleasure to make it in every way as efficient for good as possible in relation to our public schools. Here, among the children, habits of thought and feeling in regard to the benefits and uses of tree planting can be formed, which will deter them, it is hoped, from that destructive greed which has forgotten the value and beauty of green woodlands and parks, and the glory of shadowy hills and leaf-hidden streams where the trout snaps the unwary fly and the liverworts peep out from the dewy moss and wake-robins nod their heads to the answering ferns. Children need, in their innocent up-springing, to have room to get away from the garish sun and rest, as upon a mother's bosom, in the twilight silence of the growing woods. We have endeavored to keep in view, so far as possible, the educational power of such things by urging that our school grounds be supplied with shade trees and shrubs and flowers, and that the naked walls of our school buildings be trellised over with vines. Children feel most deeply the ministry of that which charms the eye.

We are what sun and winds and water make us;
The mountains are our sponsors, and the rills
Fashion and win their nursling with their smiles.

Unconsciously each impression of such character sinks into the tender depths of their souls and there it remains as in reflection do the willows in the placid stream. In fact, the scenes of nature are perennial companions, growing more friendly from

year to year. Those most familiar, wherever we may be, are ever entering the study of our imagination and often giving direction even to our acts. "The shepherd," as with exquisite pathos has been said by Wordsworth, "is half a shepherd on the stormy sea, and hears in piping shrouds the tones of waterfalls and inland sounds of caves and trees; and in the bosom of the deep sees mountains, sees the forms of sheep that grazed on verdant hills."

Arbor Day, repeated in our schools from year to year, will cultivate a reverent love of nature, will lead our children to value studious walks along our streams and hills and through our winding valleys and wide. windy sweeps of harvest fields and meadows, and into our bosky dells to waken courteous Echo to give them answer from her mossy couch.

There is, indeed, a power and a culturing beauty in all this which every child may experience if he will; and Arbor Day serves to enforce it upon his thought. Why should not our school children cherish a holiday which brings them into direct sympathy with the sweet companionship of man with nature? Why should they not offer their aid in giving to our school-grounds green lawns over which the wind-stirred trees may scatter gold and porphyry—where the laughing daffodils may welcome the returning swallows, and glowing clusters of chrysanthemums may soften the cold of autumn winds with thoughts of summer? Why should they not surround their school home, which they must so soon leave for the harsh toil of business life, with all that can make the memory of it a joy forever?

VALUE AND USES OF ARBOR DAY

A very just tribute to the value and uses of Arbor Day will be found in the address of Prof. George Mull, of Franklin and Marshall College, in connection with the observance of the day at the High School, Lancaster, Pa.:

Arbor Day is no longer a novelty, confined here and there to isolated districts, and attracting attention in the minds of few as a conspicuous evidence of an enlightened public sentiment in a few favored localities. A good thing is always sure to make its way, and it can not be said that this particular good thing which claims our consideration to-day was slow in making its way into the heart of public-school life throughout the length and breadth of our country. Scarcely heard of, barely thought of, a few years ago, it was possible to make the statement, at the American Forestry Congress, last December, that Arbor Day is now kept in nearly every State of the Union and in some of the Territories, and, indeed, in one State, South Carolina, a whole week is now devoted annually to tree planting. Such a rapid and widespread adoption of the custom is a sufficient indication of the merits of its claim to popular favor. It is hardly time yet to count the cost and estimate the results, but from what has already been done there can be no doubt that the practical benefits accruing to the material well-being of the country from the faithful observance of the day, will, in the near future, by the incontestable proof of what the eye may behold, establish the wisdom of those who have the honor to be numbered among the founders of this most excellent institution. With reference to this phase of the subject—the bearing it has upon the material prosperity of the country—there can be no difference of opinion. Everyone who is familiar with the statistics showing the rapid destruction of our forests will readily agree that there is urgent need that the public attention should be directed to tree planting, and there is no other medium through which this can be so effectually accomplished as through the public schools. It was wisely ordered, therefore, that the public schools should be enlisted in the work of conserving the material prosperity of the State in this important respect.

But while there can be no doubt that Arbor Day owes its institution primarily to economic considerations, and that upon this ground it met with so swift a response of popular recognition and interest, it is equally certain that the founders of the day builded better than they knew. For the broad and beneficent results flowing from this movement are not to be estimated in their sum total by the impressive array of cold figures in statistical tables—not even though they reach the enormous proportions of "605,000,000 trees planted in the single State of Nebraska, and now thriving there, where a few years ago none could be seen except along the streams; and this used to be called 'The Great American Desert,' where seventeen years ago the geographies said trees would not grow—and now the leading State of America for tree planting."

But this, though it be a matter for congratulation and rejoicing, conveys but a faint idea of the importance of the day as touching the very springs of our social life by its intimate connection with the public schools of the Commonwealth. More than this, if merely utilitarian or purely commercial considerations are to dominate our reflections upon this day, then we have no hesitation in saying that the day had better not been instituted. For in the midst of the intense activity of the present age, when all around us we see the plainly marked tracks of that myriad-shaped spirit of the times, whose tendency is ever toward the practical and material side of life, and which can see little or no good in anything that has not its immediate fruitage in palpable results to be measured by the yardstick, weighed in scales, and counted up in bank books; when, in the significant language of a thoughtful public school man, "knowledge is no longer regarded as the wings wherewith we fly to Heaven, but the claws with which we burrow into the earth in search of its glittering treasures;" when, in a word, we are confronted on all sides by forces that irresistibly impel us foward in the lines of practical pursuit with a natural leaning toward selfishness and greed; under these circumstances, surely, there would seem to be no need to give impetus to a stream that has such a strong current of its own by making a special effort to set before the children of the Commonwealth the observance of this day, as an object lesson in tree planting, upon grounds of thrift and public economy alone.

Happily there is another phase of the question which makes the celebration of Arbor Day altogether commendable. I refer to the educational value it possesses, which, indeed, is not to be estimated by the stores of useful knowledge clustering around it and finding through this channel an easy way into the mental equipment of the scholars. The wise teacher, to be sure, will not fail to utilize the occasion as one of the best means placed at his disposal for the purpose of imparting practical instruction in the department of botanical science. The significance of this feature is not to be underestimated. It is of unquestionable importance, but there is still a higher importance attaching to the celebration of the day, viz, the cultivation of a feeling for nature, by bringing us into touch and sympathy with the wondrous works of the Great Creator as revealed in the manifold forms of beauty—the endless variety of his handiwork throughout the vegetable kingdom. We are so wrapped up in our daily pursuits, so immersed in the things of flesh and sense that are of necessity involved in the unceasing struggle for existence and for a comfortable living, that the deeper spiritual forces of our being are in constant danger of being suppressed. We need something to draw us away from the hardening conditions of a life centered in self and absorbed in the purely material aspect of things. Especially do we need something to create and stimulate in the hearts of our children a genuine love for the works of nature. This can not be done by the text-book study of botany—no more than the treasures of literature can be appropriated and made a heart possession by the study of grammar. It can not be done by studying nature solely in the interest of scientific truth.

To this, one of the world's greatest students of nature, Charles Darwin, has borne conclusive testimony. Indeed, it is inexpressibly sad to hear him in his later years, when the "frontlet of olive culled far and wide" was vying with the "ivy leaf, the meed of learned brows" to grace the chaplet of his enduring fame, declare in the undertones of lamentation that he could not endure to read a line of poetry, that Shakespeare was so intolerably dull as to nauseate him, that he had almost lost his taste for pictures and music, that fine scenery failed to cause him the exquisite delight it formerly did, and that his mind seemed to have become a kind of machine for grinding general laws out of large collections of facts, resulting in the atrophy of that part of the brain on which the higher tastes depend. "The loss of these tastes," mark his words, "is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature."

Let us take the lesson to heart. It needs to be heeded, for, in the strenuous efforts that are now being put forth, with the best of motives, to make our education more and more practical, the importance of cultivating the æsthetic and moral faculties is only too apt to be overshadowed. It is possible to become too practical. "Ruskin speaks of men so 'practical' that they would turn the human race into vegetables, make the earth a stable, and its fruit fodder. There are vine dressers and husbandmen," he says, "who love the corn they grind and the grapes they crush better than the gardens of the angels upon the slopes of Eden; hewers of wood and drawers of water, who think that the wood they hew and the water they draw are better than the pine forests that cover the mountains like the shadow of God, and the great rivers that move like his eternity." For all such, nature speaks in no intelligible voice, Milton's grand epic has no meaning because it "proves nothing," the healthy and elevating tone of the writings of a Wood and a Jefferies touches no responsive chord, and these loving interpreters of nature have their books rated "heavy" by the trade. "We observe the face of nature so little, that the few enthusiasts who have come to know her speak to us, when they would describe her beauties, in an unknown tongue."

The planting of a tree, the tender care bestowed upon it, the eager watching for new developments in its growth, the tending of a flower bed, the training of a vine, will for many a child prove the "open sesame" into the charmed circle of those forces and factors of the natural world which purify, refine, and ennoble the heart of man. The process itself can not be indicated. It is secret, silent, past finding out. It is a growth—that subtle something, which is forever escaping the clutch of the keenest investigator, only to find easy access to the soul of him who hath eyes to see and ears to hear what is revealed of the Infinite in the finite order of creation.

> Powers there are
> That touch each other to the quick—in modes
> Which the gross world no sense hath to perceive,
> No soul to dream of.
>
> —[Wordsworth.

Though we may not analyze these mysterious powers which touch us at every point of our natural environment, quickening our impulses, warming our affections, exalting our thoughts, purifying our tastes, enlightening our whole being, we know enough of them to prize them at their full value. Nor is this beyond the range of the practical. For what is more truly, more wisely practical, than to set in operation forces and influences that will contribute to the personal happiness and comfort of the individual? What more practical, than to introduce into our homes an appreciative sense of the beautiful, the healthful, the useful in nature? It is but a step from the school to the home, and it is clearly the part of practical wisdom to make that step as fraught with beneficent results as it is possible to effect in the school.

A right feeling for nature means infinitely more than the planting of trees. By a necessary law of association, it embraces a wide range of conditions in our everyday life. It means a greater exhibition of tenderness, thoughtfulness, and gentleness in our social intercourse; it means a greater regard for orderliness, neatness, and beauty in our surroundings. A tree planted needs attention and care, which can not be bestowed without entering into the general habit of the planter; it may need a box to protect it; the shrub or bed of flowers suggests the well-kept lawn or the more modest grassplat; and these in turn point to a neat fence, a clean yard with trim walks, a painted house, and within, tidy rooms, decorated walls, pictures and books, good cheer and comfort. It will be readily admitted that these things can not be, without affecting wholesomely and only for good the moral tone of the family life, and, through it, that of the community.

PLANTING TREES A PATRIOTIC DUTY.

Not less interesting and pertinent is the address of Dr. J. T. Rothrock, State commissioner of forestry of Pennsylvania, to the public schools of Lancaster on Arbor Day of last year:

Less than three centuries ago, in the providence of God, our ancestors fell heirs to a land which was not only well watered and fertile, but well wooded. It is fair to say that on the eastern slope of the continent there was no second area equal in size to Pennsylvania which possessed resources so varied and that bid fair to last so long. So rich was our inheritance that we felt we could never come to want or see the end of our resources. American extravagance has become a byword among other nations, and Pennsylvania is in no respect behind others in the sisterhood of States.

But already practically 75 per cent of our State is destitute of real forest growth, and to meet the wants of a rapidly increasing population we are now importing lumber. Not only this, but from about an eighth of the land which we have cleared we have so exhausted the fertility that it can no longer be made remunerative in agriculture. In at least one county of our State we have the word of the president judge that the barren hillsides are being deserted by their population because they can no longer wring a living from the impoverished lands.

Thus far mankind has derived its food from the soil or the water. In the statehouse of Massachusetts there hangs a figure of a codfish, to indicate that from the sea that great Commonwealth derives a large part of its support. Our waters are practically barren, and our strength must come from the soil. I desire now to leave a question with the young people of Lancaster. It is this: If on the one hand we double our population in about thirty years, and if, on the other hand, we continue to make so much of soil poorer every year, how will those who come after us obtain a living? Bear in mind that when you render the soil incapable of producing a crop you cut off the head of the State. Thirty years and more ago our nation's life was in danger. From the hillsides of Pennsylvania more than two hundred thousand brave men poured down to save the country, that your lives might be peaceful, happy, and prosperous. I know you love the dear old flag around which so many of us rallied. I know that there is not a boy or girl before me but thinks the red, white, and blue of "Old Glory" are the very brightest and best colors that fly in the breeze of any land. Its ample folds mark the thousands of schoolhouses where you are taught to become good men and women and patriotic citizens. But you are now called upon to save the State from wasting its strength, and from becoming weak and poor, when it should be strong and rich. God never allowed a child to grow up to be a citizen without providing something for him or her to do for the public good. Every citizen should in some way aid in making every acre of the State as productive as it can be made. Of all things, a useless soul and a useless acre are the most useless. I call upon you young people here, who are thinking already what you will do when you grow up, to resolve that you will be patriots, and help make the land in which you live as near a paradise as you can. You will be wiser if you begin at once to do some good thing. Here is a chance. Every tree that is planted helps to save water for the uses of the people. It helps to restrain the floods which destroy life and property. It helps to keep the air in pure condition for you and your associates. It helps to moderate the climate so that crops may grow and fruits mature.

If, then, you plant a tree, you increase the wealth and strength of the Commonwealth, and at the same time you aid in husbanding its resources. Is not this a worthy work? But it is so small a thing, you may say! True, but life is made up of small things. How many really great things can anyone do? The great acts of any man's life are few. It is the multitude of small deeds which makes life important.

Nebraska was once almost a treeless area. Now it is a well-wooded State. This is almost entirely due to the Arbor Day planting which Secretary Morton started a score of years ago. His example has spread from State to State, until over almost the entire Union a day is set apart every year for the purpose of tree planting. European countries are taking up with the idea. It has spread to the isles of the ocean. If we except Christmas and Easter, there is probably no anniversary more widely celebrated than Arbor Day. Of course the date must vary with the country. In our Southern States, February 22, the birthday of Washington, is often selected as Arbor Day.

I desire especially to call attention here to a mistake too often made in connection with Arbor Day: This is the planting of foreign instead of native trees. It is now well known that no foreign species except possibly the Eastern plane tree is so long-lived as the corresponding native species. As between foreign and native trees, then, give the first place to our own species. In the country, as in smaller towns, nothing is better than our white oak, a native elm, or a sugar maple. Do not plant the silver maple. It is too weak to support its own enormous growth. It must be cut back. This opens the way for decay, and just when your tree should be in its prime it is in the stage of decay.

Reforms mature slowly. See with what infinite persecution the emancipation problem was worked out! Before our land became in deed and in truth "the land of the free," every hamlet received its baptism of blood and every citizen felt the drain upon his finances.

The great temperance reform has grown from contempt into respectability, and before you young people are in the prime of life you will see under restraint the monster of intemperance, which brings untold agony into thousands of homes. So it is with the forestry problem. We are now passing from the period of destruction to the period of restoration. Hardly a State in the Union but is concerning itself with this great reform. Pennsylvania has earned a first place as a pioneer in the movement. In my travels over the country I see on all sides the signs that a reformation is at hand. When I was a lad I never saw or heard of planting a tree in a school yard. Now, in the remotest parts of the State, I see growing in school yards the trees under whose ample branches the children of the next generation will play.

I look on the hopeful side of things. The world has constantly been, in the main, becoming better fitted for the prosperity and comfort of men. It is the natural order of evolution. It is not too late to restore our forests on land where nothing but trees will grow. It is not too late to make our roadsides, our school yards, our swamp land, and our barren ridges eloquent witnesses of God's willingness to help us beautify our living places, and perpetuate the prosperity of our Commonwealth. You may never command armies, or thrill a listening nation by your eloquence; but you may at least, each one of you, leave a thrifty, growing tree, or more than one, to show those who follow that you were unselfish enough to labor for the benefit of posterity that you may never see. You may at least exemplify the noble justice of leaving the world in as good condition for the prosperity of your children as you found it for yourselves. All this you may do by simply planting a tree, which will grow while you sleep and draw its strength and its long life and large usefulness from the sunshine and the storm, costing nothing, "harming no one, blessing everyone, and pleasing God." Will you do it?

Suppose each child in the State of Pennsylvania between the ages of 5 and 17 years plants a tree which grows to a mature size. Put these all together at 15 feet apart, and you will have a forest of 11½ square miles. That means 7,360 acres of forest—good, productive forest. Each acre of such forest can, in the growing season, give back to the air about 14,500 tons of water by evaporation or transpiration. In other words, as the result of planting one tree for each school child of to-day there might be distilled back into our air, from this eleven and more square miles of forest area each growing season, 106,720,000 tons of water.

Now I want to ask you if you know what that water does up in the sky. It destroys the frost which kills your crops. That is, each one of you here who plants a long-lived tree of a kind that may grow to large proportions, will, when it has grown to middle size, be placing away up there in the sky over seventy tons of water each year, which is to help protect and produce the grain on which your grandchildren will live. Indeed, it may be, you will find when you are done with earth that you have placed something in the sky of more importance still. You know that to "love your neighbor" is half of the Divine command. Will you plant a tree somewhere this year?

SCHOOLS OF AGRICULTURE AND HORTICULTURE.

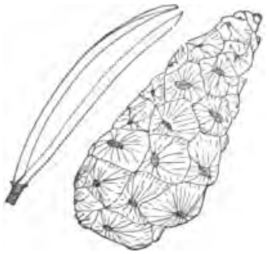
The relation of Arbor Day to agriculture and horticulture is well set forth by Hon. Charles R. Skinner, State superintendent of schools, New York:

There is a practical as well as a sentimental side to Arbor Day. It had its inception in a commendable movement looking to the protection of our forest trees, and what may be called the making of new forests on the vast plains of the West. The sentimental feature attached to its observance has been in the development of a love for Nature and her wonderful works, and in the encouragement to delightful study of trees, plants, flowers, and birds. There is no doubt that in hundreds of thousands of the children of our country there has been awakened a deep interest in the attractive study of how plants grow, of the use and abuse of trees, and of the relations which birds and flowers bear to the problem of Nature and to human happiness. A child who learns to love trees and flowers and who derives happiness from them can never go entirely wrong. The whole subject tends to a closer study of Nature in all who have a love for growing things. This study of Nature can be turned to practical use, and be made of lasting benefit to many thousands of the world's workers, especially to those whose privilege it is to till the soil—and from the farms to feed the world. There is a lack of knowledge of the scientific principles of agriculture. This lack increases manual labor without increasing results or happiness. How to make farming pleasant and profitable, how to increase its attractions, how to keep the boys on the farm are some of the problems of our times. There are mysteries of Nature which a well-educated agriculturist can solve with profit and pleasure. Ten acres scientifically tended can be made as profitable with less labor as one hundred acres carelessly cultivated. The brain should relieve the hand. Education should abolish drudgery. There is profit as well as poetry in "a little farm well tilled."

Then let us make a place in our educational system for schools of agriculture and horticulture. Our agricultural colleges have their places in the system, but they are beyond the reach and above the heads of a great majority of the boys who are to be the farmers of the future. While our common schools are laying the foundations of an all-around education, let us give our children practical lessons which will help on the farm. We may not teach all our boys to be farmers, but we may give those who go from the schools back to the farms a knowledge which shall arouse a love and an enthusiasm for agricultural pursuits which they could never otherwise obtain. This love would do more than any other influence to keep our boys on the farms. It is the child who shows most enthusiasm in study and in play. Then let us teach our children the simple lessons in botany, chemistry, geology, and

zoology, with which they may combine the study of the habits of plants and trees, how they grow and develop; the study of birds, which are the friends and not the enemies of mankind; the study of the composition of soils, the chemistry of fertilizers, the needs of grasses and grains, and the harm of noxious weeds. Let them learn that what is taken from the ground must be paid back; that there is a reciprocal relation between the soil and the fertilizer, as between the giver and receiver. How to graft, how to plant and transplant, how to save and how to prune, how to sow and how to reap, are among the things which should be taught. Give us courses in the common schools for the boys and girls who want them, which shall teach some of the pleasant things connected with farming. Teach also that it costs no more to produce a pound of good butter or cheese than a poor one. Give us a garden by the schoolhouse where the lessons of Arbor Day can be practically illustrated, where children can plant and water, where they can see things grow, see nature develop, see life in soil and plants. France is doing much in this direction, and Canada is agitating the question. Arbor Day should give us educated farmers.

ENCOURAGING WORDS FOR ARBOR DAY.



Beneficent influence of Arbor Day.—It must be borne in mind that Arbor Day is not a holiday, but simply a particular day set apart for special instruction in all that pertains to the most useful and beautiful of the kingdoms. It would not be amiss if a day were given to each of the other kingdoms, the animal and the mineral, for the same purpose. That Arbor Day has been of incalculable value, æsthetically and ethically, is no longer doubted; and, with this generation, trees around a schoolhouse are not looked upon as a source of supply for convenient instruments to maintain discipline, as they probably were a decade or two ago. The vandalism that begins with cutting and marring the school desks and destroying school shrubbery has disappeared, which is one of the innumerable arguments in favor of its beneficent influence upon the malicious passions of the young.

The lessons learned about trees, plants, and flowers since the institution of Arbor Day has caused us to observe more closely and to love more ardently these gifts of nature. Our greatest poets and statesmen have written reverently of these treasures, and spoken with sublime veneration and patriotic fervor about those of a historic reputation. The literature associated with this kingdom excels all others in purity and devoutness, and millions of the present school generation will recall these days as the one green, glowing oasis in a long life. Henry Thoreau said: "The intellect of most men is barren. It is the movings of the soul with nature that makes the intellect fruitful, that gives birth to imagination."—John Terhune, superintendent, Bergen County, N. J.

Not merely a day for tree planting.—When this day was first appointed I felt that it was not intended for us. We did not need it. Trees were abundant on our streets and around our houses. But since we have kept it, as we have for the past two years, I have had my eyes opened to its importance. We may have trees in abundance, but there is a lesson to be taught on this day that can not be put too strongly before our children. It is a day when we should strive through general exercises, and by plain talks from the teachers, committeemen, and others who may be induced to address the children, to impress upon them a love of the beautiful. Remember that our schools are expected to elevate, to make better citizens, and not simply to cram the pupils' heads full of a certain amount of knowledge, in order that they may be able to make money a little easier when they grow up. We should teach them to do all in their power to beautify their homes; also aid them in adorning their schoolrooms. Let these two places be made most attractive and the work of the schoolroom will be wonderfully advanced.

The saloon perceives the importance of this idea; witness the magnificence of some of the city saloons. Let us counteract this by doing what we can to induce the child to make his home the most attractive place in the world.

A little ingenuity will work wonders. The home of the poor is often far pleasanter than the mansion; so it does not all depend on the amount of money expended.

The same effort should be made to make the schoolroom attractive. To the effect of this I called your attention several years ago when the ungraded school was removed from the room in the old brick schoolhouse to the pleasant quarters in the Byfield building. What had been an unruly school, and one that every child dreaded to attend, became instantly a model school and one that was very popular. This is a practical illustration that we should remember. We may say that it is all nonsense; that it makes no difference what kind of a room is used for a school. Here we see most conclusively that it does.—J. P. Reynolds.

Beneficial results of Arbor Day.—Arbor Day was observed this year in all the schools according to the programme prepared by the commissioner of public schools. At nearly all the schools a tree, or vine, or shrub was planted on or near the school grounds. The encouragement of this custom will give to each class a permanent possession in the school grounds, increase their interest in the school in time to come, and be a promoter of pleasant memories of school life.

The presence of trees on or near the school grounds will attract the birds, and these by their presence will aid the teachers in inculcating the principles and practices of the Society for the Prevention of Cruelty to Animals. In one school this year attention and interest have been concentrated upon a pair of robins which built their nest in a tree in the yard and in sight from the upper windows of the schoolhouse.—W. A. Briggs, superintendent.

Indirect value.—The indirect value of Arbor Day and the opportunity it affords for moral instruction are appreciated by the teachers, whose first thought is apt to be one of regret for any interruption of regular work.—T. O. Draper, superintendent.

A beautiful custom.—Another custom which we urge all of our schools to adopt is the careful observance of, and participation in, the exercises of Arbor Day, a custom beautiful, simple, useful.—F. B. Gifford, clerk.

Gaining attention.—The subject of Arbor Day is gaining the attention of the teachers and pupils more than formerly, and it is to be hoped it will continue. If properly carried out it will cause the schoolhouse grounds to become more attractive to the children. It does seem as if the grounds around the schoolhouses of our country, where congregate some thirteen millions of pupils, should receive as much attention as the grounds around the homes, for nothing can exert more influence in creating a love for the beautiful in the minds of the rising generation.—C. J. Greene, superintendent.

Not a mere holiday.—Trees everywhere exert a controlling moral influence. They make home pleasanter, as we know and feel in our everyday existence. When a boy leaves the home of his childhood his heart, in whatever land it beats, shall, like the "seashell far from its ocean bed, retain some faint whisper of its early dwelling place." In after years the sight of home and school grounds, beautified and improved, will afford gladness and pleasure as season follows season.—D. R. Adams, superintendent.

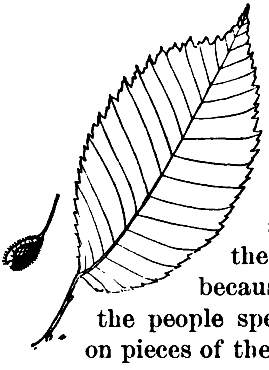
Practical use of the day.—Arbor Day and the preparation for it served to inculcate love for the whole realm of the vegetable world and much knowledge of tree and plant life. The schools also, after appropriate and interesting exercises in their respective rooms, came together at the Massasoit spring on Baker street, and planted a tree in memory of Massasoit. It might be well another year for the schools each to plant a tree on some treeless street.—A. E. Carpenter, superintendent.

Among our monumental institutions.—One of the pleasing evidences of improvement in society and the cultivation of a higher public taste is found in the establishment of Arbor Day. This interesting anniversary has not only found a place among the monumental institutions of our country, but it has met with very general and cordial approbation and support. It has its place in the calendar of our colleges, and it becomes an educational agency to all the youth of the land by its relation to our common schools. It has the support of no small number of enthusiastic advocates who promote its observance and press its claims upon the public attention, and build up around it its own peculiar and interesting literature.

As the years go by and the trees now newly planted expand themselves outward and rear themselves upward toward the sky, displaying their grand and majestic proportions, so the traditions and stories that gather round them and the day that gave them their place and their importance grow to be a living romance, blooming with elevating sentiment and bearing the fruitage of cherished associations.

When from the youth and childhood of the present proceed the names that attain to greatness and to fame, till all lands are filled with their renown, then this anniversary will bring together assemblages at the plantings of to-day to tell over with endless interest the stories of early struggles and victories, and so inspire to noble ambitions and aims the generations that are to follow.—Rev. J. Young.

TREES AND SCHOOLS.



If any persons should be peculiarly interested in trees it would seem to be those who are at school and who are especially engaged in the use of books, for the word book is the same as the old English or Anglo-Saxon word *boc*, which means a beech tree. The German *buch*, book, is almost the same as *buche*, beech; and substantially similar words are found in the Danish, Icelandic, and Gothic languages, because before the invention of printing the books of the people speaking these languages were written commonly on pieces of the bark or wood of the beech trees.

Then those who are studying Latin know that the word *liber* means both bark and book, which points to a similar usage. And those who have entered upon the study of the Greek language have learned that *biblos*, which means book, also means the inner bark of the papyrus plant, because the old Egyptians used to write upon its smooth and white surface. From the name of this plant again comes directly and easily our word paper, while to go back to *liber*, we have from that our word library, or a collection of books, and from *biblos* again our word Bible, or the book of books. And now our books are often literally made of the trees. Only instead of taking chips or blocks of the beech tree to write upon, as our ancestors did, we grind the trees up into pulp, and having spread it out into thin sheets, the printer then prints upon them lessons of geography or arithmetic or history, and lo, the beech tree and other trees also come into the school room to help us in our studies. Every time also that we turn the leaves in our books we are reminded of the trees, which have given us the word.

And then the word *academy* causes us to think of the trees, for it points us back to that celebrated school which Plato, the Greek philosopher, taught in the grove of Academus. It was a school among the trees. It was as he walked with his pupils under the branches of the trees that he taught those lessons of wisdom which have been the delight of scholars down to our own time.

Fitly, then, are the pupils in our schools invited to take part in the observance of Arbor Day, and if there is any spot peculiarly appropriate for the planting of trees on such an occasion it is that where children assemble for instruction, that thereby they may have around them the beauty and pleasantness which trees afford and every school place may become another "grove of Academe."

TREES AS LIVING THINGS.

All things in the world may be divided into two classes, things which have life and things which are without life. What life is we do not know. We know only its effects—what it does. We can neither see it nor feel it. We can not perceive it by any of our senses.

We recognize life most commonly as something which produces motion. So we say an animal is alive or has life, because we see it move. The stone is not alive; it has no motion. It does not change its shape or color. It looks to-day as it did years ago; it is no larger now than it was then. So of a piece of iron or any other metal. But the animal moves about; it changes its shape; it increases in size; it grows, as we say. From a small and very feeble thing it becomes large and strong. It is because it is a living thing or has life that it grows. The life in it has the power of laying hold of other things and building them up into the body of the animal, so that it enlarges until it has reached the size which belongs to it. So the life or life principle in us builds up our bodies little by little, and day by day, from our infancy, until we are grown-up men and women.

Now, the trees are living things like ourselves, and this gives them special interest for us. Living things have what we call organs, or instruments by means of which the life or life principle acts and performs its work. So the trees have many such organs as we have, and thereby resemble us. They have organs by which they take in food, they have lungs by which they breathe, and they have organs of digestion and a circulatory apparatus, by which their food is prepared and carried to all parts of them and causes them to grow and reach their perfection.

The trees can not move about from place to place, as we and most animals do. They would not be what they were meant to be nor of such use to us as they now are if they could. But they are none the less alive although they remain in the same place all the time. There are some animals, such as the oyster, for example, which never move about. There are also some human beings who, by accident or otherwise, have been deprived of the power to walk or to move freely, who yet are as truly alive as any. There are many plants also that have a limited power of motion which shows a close resemblance to the animals in this respect, as well as in others which have been mentioned. There are what we call the climbing plants, which climb trees or walls just as truly as boys often do. Most plants love the light and sunshine, and these climbing plants seem to climb up for the purpose of getting out of the shade of other plants and securing to themselves the needed light. So they lay hold cf any upright object near them, a stick or a tree, and winding around it or fastening their tendrils to it, climb up. Here there is motion all the time, and it can be seen very easily, especially when such a climber as the morning-glory fastens upon a short support. When it gets to the top of this it is not satisfied, but wants to go higher; so you may see it reaching out sideways and feeling around to find a new support, and it will sweep entirely around a circle, from right to left or from left to right, in order to find something to lay hold of by which it may rise still farther.

Then there are plants, like the Virginia creeper and the Japanese and English ivies, which climb walls or other objects by means of tendrils, which they stretch out like arms, and which sometimes have at their ends little disks like the suckers which boys make out of leather and with which they lift stones and other things. These disks are like so many hands, by means of which the plants climb up and hold themselves firmly where they can have the light which they need. If you try to detach one of these disks from the object to which it has fastened itself you will find it quite difficult to do so. The Venus's flytrap

(*Dionœa muscipula*) shows motion in a different way. It has at the end of its leaves an expansion like two leaves of a book ready to fold together, or like the shells of a clam. Around the margin of these leaves are bristles, with other more delicate ones in the center. When an insect alights on the open leaves and touches the central bristles, the leaves shut together so quickly that it is caught and held there till it dies. Other plants show motion in different ways. The trees also have motions independent of those which are occasioned by the wind or any external force. The locust tree and some others, for instance, fold up their leaves at night as though preparing to sleep, and spread them open again in the morning. Some move their leaves in a different manner. In all trees, also, there is in the roots a constant movement, at least during the growing season of the year. At the very beginning of its life the root as it sprouts from the seed insists upon going downward into the earth. Turn the sprouting acorn so that its root or radicle shall point upward and very soon it will turn and double upon itself, if necessary, in order to take a downward course, and though you turn it again and again, it will persist in its determination and die if necessary rather than give up the struggle. So when a tree is established and growing, though its stem must remain in the same place, its roots are all the while pushing out in various directions, winding around obstacles of one kind and another in pursuit of moisture and nourishment and making their way steadily on, so that nothing will so well describe the character of that part of the tree which is under ground as to say it is in a state of motion. Darwin, the eminent naturalist, goes so far as to claim that all the growing parts of plants, above as well as below ground, manifest voluntary motion, describing circles or circular spirals continually, "circumnutating," as he calls this movement. "If we look," he says, "for instance, at a great acacia tree, we may feel assured that every one of the innumerable growing shoots is constantly describing small ellipses, as is each petiole, subpetiole, and leaflet."[1]

The action of the life principle in the trees also often manifests astonishing force. Darwin found that the transverse growth of the radicle of a sprouting bean was able to displace a weight of 3 pounds 4 ounces in one case and one of 8 pounds 8 ounces in another. One can hardly walk where trees are growing among rocks without seeing instances of the splitting asunder of great masses of them by the growth of the tree roots which have gained entrance into their crevices when small, and in growing have expanded with irresistible force. So, also, it is a common thing to see the walls of buildings disturbed and much injured by the roots of trees growing near them. Experiments made by Professor Clark, at Amherst College, led him to think that the force exerted by a squash in growing was equal to about 5,000 pounds. Thus trees show that they are living things like us by having voluntary motion and exerting power.

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[1] Power of Movement in Plants.

Trees resemble us also as living things, and still more wonderfully, perhaps, in their choice of food. They can take food only when it is in a liquid or fluid state. They can not take any solid food, though the particles be ever so small. Nor do all trees make use of the same things for food. As they differ from one another in kind, so they require different kinds of food material in order to make them what they are. Or they require the various articles of food in different proportions one from another. They seem to have their preferences, their likes and dislikes about food, very much as we do. So, when different kinds of trees are growing together, each selects from the ground the food or the different kinds of food which will be most promotive of its growth. In this respect the trees do even better than we do, for they never take what is not good for them. The oak takes what will be best for it, and the maple what will build it up as a maple, and so of every other tree, and if the proper food does not happen to be where the tree is planted, though there may be other food in abundance, it will not become large and strong. There is hardly anything more wonderful than this instinct of trees by which they choose their food so unerringly, and the great effort which they seem to make sometimes in order to get the food they want. While they can not move from place to place, as as most animals can, because they are fixed to one spot, though some of the lower order of plants move about as freely as animals, they often send their roots long distances and over great obstacles in search of what will nourish them. Darwin, speaking of the motion of the root-tips of plants, says:

"It is hardly an exaggeration to say that the tip of the radicle, thus endowed and having the power of directing the movements of the adjoining parts, acts like the brain of one of the lower animals; the brain being seated within the anterior end of the body, receiving impressions from the sense organs, and directing the several movements."[1]

Such manifestations of life in the trees are very interesting. They are enough to make us feel that they are like us in many respects and to excite in us a sense of companionship with them, and we can hardly wonder that some people have imagined that living creatures dwelt in the trees and peopled the woods with nymphs, with dryads and hamadryads, or that in their superstition some have even worshipped trees. If we had more of that fancy of the old Greeks, that when a tree was wounded the nymph who dwelt in it was hurt or grieved, we should, perhaps, treat the trees around us with more care and have a tenderer feeling in respect to them.

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[1] Power of Movement in Plants.

TREES IN MASSES—FORESTS.

Interesting as trees are, considered singly, admirable for their beauty, every leaf a worthy object of study, we do not know their value and importance until we contemplate them in masses, or as forests. The single tree on the lawn or by the roadside may be more beautiful and excite our admiration more than any to be found in the forest, because, having abundant space and light and air on every side, it has developed itself symmetrically and to the full perfection of its nature, which the tree in the forest, more or less crowded by its neighbors, can not do. But when we come to consider the usefulness rather than the beauty of trees, we must look to the forests, those great masses which often cover whole mountains or vast plains with their continuous stretches. Let us notice, therefore, some of the uses of masses of trees, or the importance which trees have when growing together in large numbers, and which does not belong to the tree when considered singly.

In the first place, then, it is from the forest that we obtain the fuel by which principally we warm our houses and sustain the fires in most of our furnaces and factories. It is from the forest that we obtain the timber for the construction of our houses, our ships, our railway cars, and the track upon which the cars are borne so smoothly and safely. It is the forests which supply us with the raw material that is wrought into so many objects of usefulness and convenience. Professor Sargent, who undertook ten years ago to ascertain the condition of the forests of the United States, estimated the yearly value of the lumber, fuel, and other forest products at that time as more than $700,000,000. Their value is now at least $1,060,000,000, a sum that exceeds the value of our crops of wheat, oats, rye, corn, and tobacco taken together, and is greater than that of all our exports, and more than fourteen times as great as the produce of our mines of silver and gold. It is estimated that we consumed last year, of sawn lumber alone, more than 36,000,000,000 square or superficial feet. But such figures by themselves are meaningless. Let us consider, then, that this amount of lumber would load a train of cars sufficient to encircle the earth at the equator. And now, if we add to the sawn lumber, which is only a small part of the total produce of the forests, the timber, the railroad ties, the telegraph poles, the posts for fences, and the wood cut for fuel and for mining purposes, we shall have a train 100,000 miles in length, or long enough to reach four times around the globe. The weight of these forest products would be enough to load 480,000 ships of 1,000 tons each.

When we see thus what a vast amount of material of various kinds is taken from our forests every year, we have a most convincing proof of their value. We see at a glance how indispensable they are to our welfare, how many industries they must sustain, how many comforts and conveniences they must provide for all.

The importance of the forests and their usefulness to us may be shown, not only by such figures as we have just given, which indicate their total product, but in a contrasted way by considering some of what may be called the unthought-of uses of the forest, because they are concerned with articles individually so small and insignificant.

A toothpick, for instance, is a little thing, the merest sliver of wood, yet it is reported that one factory uses 10,000 cords of wood annually in the production of these splints.

Shoe pegs are small affairs, yet a single factory sends 40,000 bushels of them to Europe yearly, besides what it disposes of at home.

A spool is of small account to us when emptied of the thread which has been wound upon it, yet there are several factories which use each from 1,800 to 3,500 cords of wood every year in making these little articles, and in one factory 150 men are said to be employed in their manufacture. Thousands of acres of birch trees have been bought at one time by some of our thread manufacturing companies, for the sole purpose of securing a supply of spools.

Who thinks much of the little friction match, as he uses it to light his lamp or his fire and then throws it away? But a single factory, it is said, makes 60,000,000 of these little things every day, using for this purpose 12,000 square feet of the best pine timber.

It will help us also to understand how much we are indebted to the forests when we find that we consume $12,000,000 worth of lumber every year for the packing-boxes alone which are required simply for the transportation of our various commodities from the producers to those who use them, and are then destroyed.

In what has been said now about the products of the forests and the benefits which they confer upon us, only a few out of many things have been mentioned. Nothing has been said of the gums and resins and spices which they afford, and which are of so much service to us. What a loss would it be to us, for instance, if we were to be deprived of india rubber and gutta-percha, or of the resin and turpentine of our pine trees, yielding us a product annually valued at $8,000,000. What could take their place? How many uses we have for them, uses many of which seem indispensable. How important to us also is the bark of many trees. We are dependent upon it for our leather. We can not put on a shoe or walk the streets without being reminded of our indebtedness to the trees. How many valuable dyestuffs, also, and how many healing medicines are obtained from the bark, as well as from the leaves and other parts of the trees. From their seeds and nuts, also, what valuable products are derived. In some countries these supply a large part of the food of the people.

But the forests are of great importance to us not only on account of what they thus yield directly for our use and comfort, but on account of their relations to climate and health, to the flow of streams, and to the great interests of agriculture, commerce, and manufactures.

By reason of the deep, spongy soil formed by the decay of their leaves through a succession of years the forests become great storehouses of moisture. The rain which falls upon them, instead of being evaporated as it is from the open ground or flowing off at once into the streams, perhaps with destructive violence, sinks into the soft and retentive soil, from which it flows out gradually into the neighboring runlets and brooks and thence into the larger streams, and preserves in them an equable flow, preventive alike of flood and droughts. It is estimated that four-fifths of the water falling on wooded areas is retained by them, whereas on those which are without timber cover only one-fifth is retained, the other four-fifths rushing off in torrents and often producing disastrous floods. Through many an under-ground channel, also, the stored-up water of the forests reappears in springs in the meadows and elsewhere, to slake the thirst of man and beast and give delight to old and young. The forests are thus our great regulators of water supply. They also protect us and protect our crops, our fruits, and our flocks from the violence of the winds. What we call a gentle wind is pleasant, but we all know that the air can move with destructive violence. We all know, also, how grateful is the shelter which a grove or even a narrow belt of trees affords from a cold wind. When the air is still it may be quite cold without occasioning us much discomfort; but when it is in motion it absorbs the heat of our bodies more rapidly by the more frequent contact of its particles with them, and this may go so far as to be very painful and, perhaps, destroy life. Now, the forests, or even a few rows of trees, greatly check the movement of the winds and thus protect us both from their chilling effect and their violence. They do the same for the crops in the farmer's fields and the fruits in his orchards. They prevent them from being withered and blasted by cold or hot winds or from being broken down by their force. People, in some of our western States especially, have found "shelter belts," as they are well called, almost indispensable to the successful cultivation of some crops.

By equalizing the temperature and moisture of the atmosphere as they do, and by other influences which they exert, the forests are also promotive of health. A region of forests, especially if it is elevated, is a healthful region. So we know what multitudes resort every year to the White Mountains of New Hampshire, and to the Adirondacks and the Catskills, or to the great forest regions of the South or of the Rocky Mountains, and how beneficial to health they find them.

In whatever aspect, then, we contemplate the forests we see that they are of the greatest value to us.

TREES IN THEIR LEAFLESS STATE.

As the season for Arbor Day and tree planting comes on, just before the buds begin to swell and are getting ready to cover the trees with a fresh mantle of leaves, it is well—as it is also when the leaves have fallen from the trees in autumn—to give attention to the bare trees and notice the characteristic forms of the various species, the manner in which their branches are developed and arranged among themselves, for a knowledge of these things will often enable one to distinguish the different kinds of trees more readily and certainly than by any other means. The foliage often serves as an obscuring veil, concealing, in part, at least, the individuality and the peculiarities of the trees. But if one is familiar with their forms of growth—their skeleton anatomy, so to speak—he will recognize common trees at once with only a partial view of them.

Some trees, as the oak, throw their limbs out from the trunk horizontally. As Dr. Holmes says: "The others shirk the work of resisting gravity, the oak defies it. It chooses the horizontal direction for its limbs so that their whole weight may tell, and then stretches them out fifty or sixty feet so that the strain may be mighty enough to be worth resisting."

Some trees have limbs which droop toward the ground, while those of most, perhaps, have an upward tendency, and others still have an upward direction at first and later in their growth a downward inclination, as in the case of the elm, the birch, and the willows. Some, like the oak, have comparatively few but large and strong branches, while others have many and slender limbs, like some of the birches and poplars.

The teacher should call attention to these and other characteristics of tree structure, drawing the various forms of trees on the blackboard and encouraging the pupils to do the same, allowing them also to correct each other's drawings. This will greatly increase their knowledge of trees and their interest in them as well as in Arbor Day and its appropriate observance.

LEAVES, AND WHAT THEY DO.

The leaves of the trees afford an almost endless study and a constant delight. Frail, fragile things, easily crumpled and torn, they are wonderful in their delicate structure, and more wonderful if possible on account of the work which they perform.

They are among the most beautiful things offered to our sight. Some one has well said that the beauty of the world depends as much upon leaves as upon flowers. We think of the bright colors of flowers and are apt to forget or fail to notice the coloring of leaves. But what a picture of color, beyond anything that flowers can give us, is spread before our sight for weeks every autumn, when the leaves ripen and take on hues like those of the most gorgeous sunset skies, and the wide landscape is all aglow with them. A wise observer has called attention also to the fact that the various kinds of trees have in the early springtime also, only in a more subdued tone, the same colors which they put on in the autumn. If we notice the leaves carefully, we shall see that there is a great variety of color in them all through the year. While the prevailing color, or the body color, so to speak, is green, and the general tone of the trees seen in masses is green—the most pleasant of all colors to be abidingly before the sight—this is prevented from becoming dull or somber because it comprises almost innumerable tints and shades of the selfsame color, while other distinct colors are mingled with it to such an extent as to enliven the whole foliage mass. Spots of yellow, of red, of white, and of intermediate colors are dashed upon the green leaves or become the characteristic hues of entire trees, and so there is brought about an endless variety and beauty of color.

Then there is the beauty of form, size, position, and arrangement. Of the one hundred and fifty thousand or more known species of trees the leaves of each have a characteristic shape. The leaves of no two species are precisely alike in form. More than this is also true. No two leaves upon the same tree are in this respect alike. While there is a close resemblance among the leaves of a given tree, so that one familiar with trees would not be in doubt of their belonging to the same tree, though he should see them only when detached, yet there is more or less variation, some subtle difference in the notching or curving of the leaf edge perhaps, so that each leaf has a form of its own. These differences of shape in the leaves are a constant source of beauty.

What a variety of size also have the leaves, from those of the birches and willows to those of the sycamores, the catalpas, and the paulownias. On the same tree also the leaves vary in size, those nearest the ground and nearest the trunk being usually larger than those more remote. How different as to beauty would the trees be if their leaves were all of the same size; how much less pleasing to the sight.

Then, what a wide difference is there in the position of the leaves on the trees and their relative adjustment to each other! Sometimes they grow singly, sometimes in pairs, sometimes in whorls or clusters. Some droop, others spread horizontally, while others still are more or less erect. The leaves of some trees cling close to the branches, others are connected with the branches by stems of various length and so are capable of greater or less movement. The leaves of poplars and aspens have a peculiarly flattened stem, by reason of which the slightest breath of wind puts them in motion.

These are some of the most obvious characteristics of the leaves, by which also they are made the source of so much of the beauty of the world in which we live. It will be a source of much pleasure to anyone who will begin now, in the season of swelling buds and opening leaves, to watch the leaves as they unfold and notice their various forms and colors and compare them one with another. There is no better way of gaining valuable knowledge of trees than this, for the trees are known by their leaves as well as by their fruits.

But let us turn now from their outward appearance and consider what is done by them, for the leaves are among the great workers of the world, or, if we may not speak of them as workers, a most important work is done in or by means of them, a work upon which our own life depends and that of all the living tribes around us.

Every leaf is a laboratory, in which, by the help of that great magician, the sun, most wonderful changes and transformations are wrought. By the aid of the sun the crude sap which is taken up from the ground is converted by the leaves into a substance which goes to build up every part of the tree and causes it to grow larger from year to year; so that instead of the tree making the leaves, as we commonly think, the leaves really make the tree.

Leaves, like other parts of the plant or tree, are composed of cells and also of woody material. The ribs and veins of the leaves are the woody part. By their stiffness they keep the leaves spread out so that the sun can act upon them fully, and they prevent them also from being broken and destroyed by the winds as they otherwise would be. They serve also as ducts or conduits by which the crude sap is conveyed to the leaves and by which, when it has there been made into plant food, it is carried into all parts of the tree for its nourishment. Protected and upheld by these expanded woody ribs, the body of the leaf consists of a mass of pulpy cells arranged somewhat loosely, so that there are spaces between them through which air can freely pass. Over this mass of cells there is a skin, or epidermis, as it is called, the green surface of the leaf. In this there are multitudes of minute openings, or breathing pores, through which air is admitted and through which also water or watery vapor passes out into the surrounding atmosphere. In the leaf of the white lily there are as many as 60,000 of these openings in every square inch of surface and in the apple leaf not fewer than 24,000. These breathing pores, called stomates, are mostly on the under side of the leaf, except in the case of leaves which float upon the water. There is a beautiful contrivance also in connection with these pores, by which they are closed when the air around is dry and the evaporation of the water from the leaves would be so rapid as to be harmful to the tree and are opened when the surrounding atmosphere is moist.

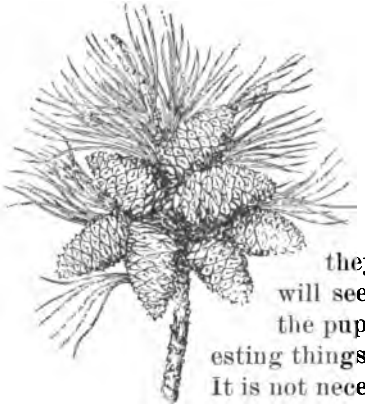
The green color of the leaves is owing to the presence in the cells of minute green grains or granules, called chlorophyll, which means leaf-green, and these granules are indispensable to the carrying on of the important work which takes place in the leaves. They are more numerous and also packed more closely together near the upper surface of the leaf than they are near the lower. It is because of this that the upper surface is of a deeper green than the lower.

Such, then, is the laboratory of the leaf, the place where certain inorganic, lifeless substances, such as water, lime, sulphur, potash, and phosphorous, are transformed and converted into living and organic vegetable matter, and from which this is sent forth to build up every part of the tree from deepest root to topmost sprig. It is in the leaves also that all the food of man and all other animals is prepared, for if any do not feed upon vegetable substances directly but upon flesh, that flesh nevertheless has been made only as vegetable food has been eaten to form it. It is, as the Bible says, "The tree of the field is man's life."

But let us consider a little further the work of the leaves. The tree is made up almost wholly of oxygen, hydrogen, and carbon. It is easy to see where the oxygen and hydrogen are obtained, for they are the two elements which compose water, and that we have seen, the roots are absorbing from the ground all the while and sending through the body of the tree into the leaves. But where does the carbon come from? A little examination will show.

The atmosphere is composed of several gases, mainly of oxygen and nitrogen. Besides these, however, it contains a small portion of carbonic acid, that is, carbon chemically united with oxygen. The carbonic acid is of no use to us directly, and in any but very minute quantities is harmful; but the carbon in it, if it can be separated from the oxygen, is just what the tree and every plant wants. And now the work of separating the carbon from the oxygen is precisely that which is done in the wonderful laboratory of the leaf. Under the magic touch of the sun, the carbonic acid of the atmosphere, which has entered the leaf through the breathing pores or stomates and is circulating through the air-passages and cells, is decomposed, that is, taken to pieces; the oxygen is poured out into the air along with the watery vapor of the crude sap, while the carbon is combined with the elements of water and other substances which we have mentioned, to form the elaborated sap or plant material which is now ready to be carried from the leaves to all parts of the plant or tree, to nourish it and continue its growth. Such is the important and wonderful work of the leaf, the tender, delicate leaf, which we crumple so easily in our fingers. It builds up, atom by atom, the tree and the great forests which beautify the world and provide for us a thousand comforts and conveniences. Our houses and the furniture in them, our boats and ships, the cars in which we fly so swiftly, the many beautiful and useful things which are manufactured from wood of various kinds, all these, by the help of the sun, are furnished us by the tiny leaves of the trees.

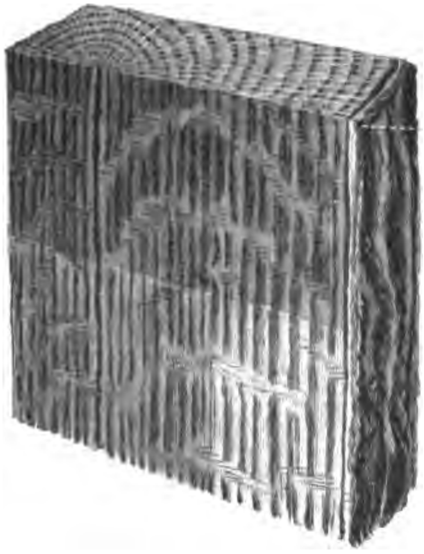
THE BEST USE OF ARBOR DAY.



Arbor Day to be most useful, as well as most pleasant, should not stand by itself, alone, but be connected with much study and talk of trees and kindred subjects beforehand and afterwards. It should rather be the focal or culminating point of the year's observation of trees and other natural objects with which they are closely connected. The wise teacher will seek to cultivate the observing faculties of the pupils by calling their attention to the interesting things with which the natural world abounds. It is not necessary to this that there should be formal classes in botany or any natural science, though we think no school should be without its botanical class or classes, nor should anyone be eligible to the place of a teacher in our public schools who is not competent to give efficient instruction in botany at least.

But much may be done in this direction informally by brief, familiar talks in the intervals between the regular recitations of the schoolroom, or during the walks to and from school. A tree by the roadside will furnish an object lesson for pleasant and profitable discourse for many days and at all seasons. A few flowers, which teacher or pupil may bring to the schoolroom, will easily be made the means of interesting the oldest and the youngest and of imparting the most profitable instruction. How easy also to plant a few seeds in a vase in the schoolroom window and to encourage the pupils to watch their sprouting and subsequent growth.

The pupils can also be readily interested in getting sections of trees so cut as to show the structure of the wood, and with a portion of the bark left upon them. It will require but a short time to accumulate quite a collection of such specimens in the schoolroom, and they will serve as a standard of reference with which to compare fresh specimens and identify them. One face of the sections should be smoothed and varnished, the others should be left as when split from the tree. The cut appended shows a good form for such sections.



Then it should not be difficult to have a portion of the school grounds set apart, where the pupils might, with the teacher's guidance, plant flower and tree seeds and thus be able to observe the ways and characteristics of plants in all periods of their growth. They could thus provide themselves with trees for planting on future Arbor Days, and at the time of planting there would be increased enjoyment from the fact that they had grown the trees for that very purpose.

Why might not every schoolhouse ground be made also an arboretum, where the pupils might have under their eyes, continually, specimens of all the trees that grow in the town or in the State where the school is situated? It would require but a little incitement from the teacher to make the pupils enthusiastic with the desire to find out the different species indigenous to the region and to gather them by sowing seeds or planting the young trees around their place of study.

And if the school premises are now too small in extent to admit of such a use, let the pupils make an earnest plea for additional ground. As a general fact our school grounds have been shamefully limited in extent, and neglected as to their use and keeping. The schoolhouse in itself and in its surroundings ought to be one of the most beautiful and attractive objects to be seen in any community. The approach from the street should be like that to any dwelling house, over well-kept walks, bordered by green turf, with trees and shrubs and flowers offering their adornment. Everything should speak of neatness and order. The playground should be ample, but it should be in a retired situation and by itself.

Europeans are in advance of us in school management. The Austrian public school law reads:

"In every school a gymnastic ground, a garden for the teacher, according to the circumstances of the community, and a place for the purposes of agricultural experiment, are to be created."

There are now nearly 8,000 school gardens in Austria, not including Hungary. In France, also, gardening is taught in the primary and elementary schools. There are nearly 30,000 of these schools, each of which has a garden attached to it, and the minister of public instruction has resolved to increase the number of school gardens, and that no one shall be appointed master of an elementary school unless he can prove himself capable of giving practical instruction in the culture of mother earth. In Sweden, in 1871, there were 22,000 children in the common schools receiving instruction in horticulture and tree planting. Each of more than 2,000 schools had for cultivation from one to twelve acres of ground.

Why should we be behind the Old World in caring for the schools? By the munificence of one of her citizens New York has twice offered premiums for the best-kept school grounds. Why may we not have Arbor Day premiums in all of our States and in every town for the most tasteful arrangement of schoolhouse and grounds? These places of education should be the pride of every community instead of being, as they so often are, a reproach and shame.

TREE PLANTING.

In considering tree planting in connection with Arbor Day, the first question to arise is, Where shall we plant? It is obvious that the practical work of Arbor Day can not include forest planting. That is a work so large and special in its nature as to require the combined effort of persons in an organized capacity, such as a town, county, or State, which shall either do the work outright or give such encouragement and help as will stimulate individual effort to the requisite degree. Arbor Day observances, to be sure, should not lose sight of the fact that we need something besides planting trees by the roadside or on the lawn, or here and there one in memory of some distinguished person; something more than the landscape gardener's art in planting appropriately public parks.[1]

These works of minor importance should lead to such a knowledge of the uses of trees in masses—the extensive forests—in connection with climate, with the flow of streams and consequently with agricultural operations and with manufactures, in short, with the general interests of household and business life, that in due time there will be developed a sentiment that will be powerful to arrest the wasteful and unnecessary destruction of our forests and insure the planting of them in places from which they have been removed or where they are specially needed. One thing is to be remembered and it is calculated to lend effectiveness to the work of Arbor Day. It is that trees are living and self-propagating things; that it is their nature to grow, and that they will grow and extend themselves on every hand if not interfered with and thwarted by man. As an illustration of this we see the abandoned farms on our hillsides soon filling up with a wood growth. It may not be of the most valuable or desirable character, but it shows what nature is ready to do, and it indicates a direction in which the influence of Arbor Day may be made effective.

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[1] The Department of Agriculture has treated the subject of forest planting in Bulletin No. 5, "Forestry for Farmers," recently published.

Let it be understood that the hills and mountain slopes are worth more for the growth of trees than for agricultural use, or rather that the tree crop is the most appropriate agricultural crop for the hill and mountain slopes, the rocky surfaces which resist the plow and the hoe. Let the farmer learn that if he will but exclude from his woodlands the browsing cattle, which are ready to eat off every tender tree as it sprouts from the ground and to break down with their heavy bulk those which have already attained a hopeful size, and if he will cull the inferior trees instead of the best, for his occasional uses, and fill the too wide vacant spaces with a judicious planting, he may soon have a woodland, though it may not have the dimensions of a forest, which will be of manifold benefit to him as well as to others and be increasing in value from year to year. This use of elevated and rocky lands, where ordinary agriculture is difficult and comparatively unremunerative, ought to be encouraged by the Arbor Day movement. It may and should make itself felt in this direction.

The same is true in reference to many sandy and swampy lands. These will nourish trees and prove a perpetual source of income. Trees, unlike the ordinary farm crops, continually improve the quality of the ground on which they grow. The German Government, in its wise and careful management, is constantly buying up the worn-out or impoverished farms of its husbandmen and by stocking them with trees restoring their fertility and fitting them again for agricultural use. On a great many of our light, sandy soils, now left as wind-swept barren fields or yielding only the most meager crops, a growth of that most valuable tree the white pine (*Pinus strobus*), may be secured in twenty years and even less, of marketable size. There is a great demand for the wood of this tree in its early stages, for the manufacture of staves, for tubs and small casks, as well as for other uses, and many landowners are finding it quite profitable to raise and market this pine at a comparatively early age.

This is not the place to discuss further the subject of forest planting or forest preservation, unless it be to say that perhaps a greater enemy of the forest than the ax is fire, and that wherever there is regard enough for trees to occasion the observance of Arbor Day there ought to be also consideration enough for the preservation of the forests of the vicinity to inaugurate some well-arranged and efficient plan to protect them from the flames which, kindled by accident or carelessness, are not only a detriment to the legal owner of the forest but to the whole community, for, in an important sense, the forests are common property. By their beauty, their influence upon climate and water supply, they are of benefit to all who live in sight of them and may be to those more distant from them. All, therefore, ought to be ready to make their preservation a common cause.

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STREET PLANTING.

Forests apart, if the question arises where to plant, nearly all will say plant along the borders of the streets. This is natural and right, and so the first thing which the village improvement societies, which have sprung up so abundantly of late, have done has been to plant trees on the roadsides. Unfortunately, also, this has too often been the last thing. Village improvement has frequently exhausted itself by the wayside. This speaks well for the general estimate of trees, however it may speak for the people's estimate of what constitute the needs or the possibilities of village life.

Lane at Darlington, Md.

Certainly no one thing adds so much to the appearance of town or village, or affords so much outward comfort to its people, as to have its streets properly planted with trees. As a source of embellishment nothing can surpass it. How much would it detract from the charm of Washington, celebrated for beauty on account of its broad streets, ample parks, and the plan on which they are constructed, if its 80,000 or more trees which border those streets and adorn those parks were removed? Washington would be distinctly another city than it now is. But what is true of the National Capital is true of the smaller town or village. The difference is not in kind, but only in scale or dimension.

In deciding, however, what trees are most desirable for street or roadside planting, no little difficulty arises. No general list can be made for such an extensive country as ours. Trees which will grow well and are all that can be desired in one portion of it are not suitable for another. Trees which are at home on the Pacific Coast will pine away and die on the Atlantic. Even in localities separated by only a few miles the same kinds of trees may not flourish. Differences of soil and climate, or a particular exposure, determine to a great extent what trees are to be chosen if we would be successful in our planting. In cities, the prevalence of smoke in the atmosphere, or the escape of illuminating or other gases, complicate the problem and make the selection additionally difficult.

The American Forestry Association appointed a committee several years ago for the purpose of making a list of trees most desirable for street planting, but the committee has not yet reported. To make a list large enough for the whole country would be to include so many trees that it would be of little use for any particular locality, and to make one for a given place would be of little use to the country at large. Each locality must have its selection of trees made with reference to its particular circumstances. Happily, we have an unusually large variety of trees, excelling by far that of any other country, which admits a choice of valuable kinds adapted to every situation. Trees can, indeed, be acclimated, as people can, and when removed from their native places to other and different ones can be made to adapt themselves to their new environment. Their growth, however, is apt to be more or less feeble

Street tree planting.

and unsatisfactory. Trees have their natural homes, in which they attain their best development. The geologist, as he may be traveling swiftly over the country, can ascertain the character of the soil, its mineral composition, from the prevailing kinds of trees which from time to time meet his sight.

Some trees are less particular than others in their choice of climatic or soil conditions, and therefore are available for planting over a wider range of territory and under a greater variety of exposure. They will have their places, consequently, in many lists of desirable trees.

The Tree Planting and Fountain Society of Brooklyn, N. Y., a few years ago sent a request to various nurserymen, landscape architects, practical arboriculturists, and private citizens in different parts of the country for a small list of what they deemed the most suitable trees to be recommended for planting on the streets of Brooklyn, a general description of the character of the soil of the city having been sent with the request. Three classes of trees were asked for—large, medium sized, and smaller, for wide streets, narrow ones, and those of intermediate width. The lists received were interesting as showing the varying estimates of the same tree by different persons and also the substantial agreement of the same persons in regard to a large number of trees.

Fifteen lists were sent in, and in all about sixty trees were recommended. Of these the Norway maple was most frequently found on the lists, followed in the order of preference by the sugar maple, oriental plane, laurel-leaved willow, silver maple, European linden, American elm, sweet gum, catalpa, yellowwood, pin oak, white oak, American linden, or basswood, hackberry, scotch elm, kœlreuteria, and tulip poplar. The other trees on the lists were named only in one or two instances each.

In another list, sent from the Division of Forestry of the Department of Agriculture, and in which the rating of the trees was made up from a consideration of eight separate points, viz, endurance, or ability to withstand more or less unfavorable conditions, recuperative power, or ability to heal wounds and outgrow other injuries, cleanliness, beauty of form, abundance of shade, extent of the season when in leaf, rapidity of growth, and length of life period, the trees stood rated in the three classes thus:

LARGE-SIZED TREES.

Red oak (*Quercus rubra*), 22.
Scarlet oak (*Quercus coccinea*), 22.
Yellow oak (*Quercus tinctoria*), 22.
American elm (*Ulmus americana*), 22.
Sugar maple (*Acer saccharinum*), 19.
Black maple (*Acer nigrum*), 19.
Tulip tree (*Liriodendron tulipifera*), 19.
European linden (*Tilia vulgaris*), 19.
Sweet gum (*Liquidambar styraciflua*), 19.
White oak (*Quercus alba*), 19.
Burr oak (*Quercus macrocarpa*), 19.
Oriental plane tree (*Platanus orientalis*), 19.
Kentucky coffee tree (*Gymnocladus canadensis*), 19.
American plane tree (*Platanus occidentalis*), 18.
Sycamore maple (*Acer pseudoplatanus*), 19.
American linden (*Tilia americana*), 17.

MEDIUM-SIZED TREES.

Red maple (*Acer rubrum*), 22.
Shingle oak (*Quercus imbricaria*), 21.
Willow oak (*Quercus phellos*), 21.
Slippery elm (*Ulmus fulva*), 21.
Norway maple (*Acer platanoides*), 20.
Box elder (*Negundo aceroides*), 20.
European elm (*Ulmus campestris*), 19.
Scotch elm (*Ulmus montana*), 19.
Hackberry (*Celtis occidentalis*), 19.
Silver-leaved maple (*Acer dasycarpum*), 17.
Tree of Heaven (*Ailanthus glandulosus*), 16.
Horse chestnut (*Æsculus hippocastanum*), 16.
Japanese sophora (*Sophora japonica*), 16.
Hardy catalpa (*Catalpa speciosa*), 16.
Ginkgo or maiden hair tree (*Ginkgo biloba*), 16.
Honey locust (*Gleditsia triacanthos*), 15.
Cottonwood (*Populus monilifera*), 15.
Balm of Gilead (*Populus balsamifera var. candicans*), 15.
Black locust (*Robinia pseudacacia*), 14.

SMALL-SIZED TREES.

English maple (*Acer campestre*), 21.
Round-top locust (*Robinia pseudacacia-form*), 18.
Red horse-chestnut (*Æsculus rubicunda*), 17.
Laurel-leaved willow (*Salix pentandra*), 17.
Bay willow (*Salix laurifolia*), 17.
Green ash (*Fraxinus viridis*), 16.
European mountain ash (*Sorbus aucuparia*), 15.
American mountain ash (*Pyrus americana*), 15.
Yellowwood (*Cladastris tinctoria*), 15.

The rating of trees in this list does not differ essentially from the average rating of the lists already referred to. Such lists can not be taken as authoritative or decisive, but only as helps. Persons of equally good judgment will differ in their estimate of particular trees, and time and trial will be needed in order to reach a final decision as to the trees best adapted for use in any given place.

It hardly needs to be said that it is only on broad streets or where buildings are set well back from the street that such widespreading trees as some of the oaks are desirable for planting; but the oaks are among our best trees where there is room for them, and they should be planted on our streets much more than they have been. For ordinary streets, and especially for those which are narrow, such trees should be chosen as do not grow to large size or such as are spiry topped. Of the latter a new comer among us may be favorably mentioned, the ginkgo. This is one of the few trees which it seems desirable to cultivate in addition to the large number of valuable native trees which we have. But the peculiarity of its form and of its leaves, which mark a blending of the broad-leafed and the needle-shaped leaves, and its wonderful golden coloring in autumn, make it very attractive, and it is well adapted for planting on narrow streets as well as singly in open, lawn-like spaces. Whoever has seen the avenue leading up to the main building of the Department of Agriculture, which is bordered with the ginkgo, must feel that it is one of the most desirable trees for similar use. What degree of cold this tree will endure remains to be seen, but it is growing well as far north as Boston.

A good word should be said also for the ailanthus. It was formerly a favorite tree, but has been discarded on account of its unpleasant odor in its flowering season. This, however, may be avoided by planting only the pistillate trees, as the odor is noticeable from the staminate trees only. Professor Sargent speaks of the ailanthus as "probably the best street tree that has ever been used in northern cities."

PLANTING ON SCHOOL GROUNDS.

Where Arbor Day is observed by the schools it will, perhaps, seem that tree planting on the school grounds deserves consideration before planting on the street borders; but the two are nearly related. If an attempt is made to plant around the schoolhouse, some street planting will almost necessarily be done in connection with it. Certainly the pupils of any school should be encouraged to plant trees about the building to which they come day after day and where so much of their time is spent. They should be encouraged to make it beautiful and attractive now with foliage and flowers, and a place to which they may look back in after life with pleasant memories.

Even the smallest school ground is large enough to admit some embellishment of tree or shrub, and even a single tree will add attractiveness to the place. Such a tree planted by the children themselves will be regarded as their common property. All will be interested in it and will combine to protect it and give it all needed care. In so doing they will learn manifold lessons in regard to tree growth and habits, in regard also to the ways of the birds and insects which will frequent it. While they are cultivating the tree they may also be cultivating in themselves the best traits of character and gaining as much as from their books. But it is to be hoped that most of our school grounds are ample enough to admit of a considerable number of trees and shrubs and flowery plants besides. Then there will be opportunity for planting a variety of trees and for a careful study in order to select the best, both for beauty and for adaptation to the place where they are to stand and grow. Care should be taken that the planting of the school grounds shall not be done hastily or without due consideration, nor that too much be done in a single season. Leave some work to be done in coming years to give new zest to the Arbor Day exercises. One tree well chosen and well planted is worth a dozen or a score selected and planted as trees often are.

With many persons a tree is a tree, and peculiarities of nature or habit of growth are taken little account of. It is enough also with many, in planting, if a hole is made in the ground and the roots of the tree, many or few, are thrust into it and hastily covered with earth again. One of the most difficult things to do is to get a tree properly planted, and yet tree planting is a very simple thing. It consists in taking a tree out of the ground without injury and placing it in the ground again in another place also without injury, and with a corresponding connection with the soil such as it had before. This simply requires time, patience, and care. Yet in planting a single tree a boy may learn a lesson of lifelong value to him.

The life of a tree depends upon its roots. Through them it gets its nourishment. But it is not through those which are large and most visible. It is through the finest roots, and still more the scarcely visible root hairs which are most abundant on the fibrous rootlets. The large roots serve as braces to hold the tree in erect position and keep it from being swayed and overthrown by the winds, and also as conduits through which the water and nourishment gathered by the rootlets are conveyed to the stem and thence to the branches and leaves. The large roots are of no use in securing the life of the newly planted tree or promoting its growth, if the rootlets are broken off or left behind when the tree is taken from its original place.

Hence the need of time and care in undertaking this removal. The roots, even in a young tree, will have spread to a considerable distance from the stem and to follow them and detach them from the soil adhering to them without breaking the tender threads is not easy. It is necessarily a slow though a simple process, and we are apt to be impatient and wish to do the work quickly. But the old proverb, "Haste makes waste," is as true here as anywhere. So is another that "What is worth doing is worth doing well." To plant a tree properly, so that it shall go on to grow vigorously and as though nothing had happened to impair its vitality, instead of barely making a feeble show of life for a while only to have a lingering death, is to give the pupils of a school an object lesson to last them and be of use to them for a lifetime. To make the lesson the more obvious and impressive, let them, under the guidance of the teacher or some one accustomed to handle trees, plant one properly, first preparing the ground where it is to have its new home, by excavating a sufficiently large hole to receive all the roots of the tree with space enough beyond to allow their unimpeded growth for years to come, carefully reducing the earth to such a fine condition that it can be brought into close contact with the smallest roots. Then, having selected the tree beforehand, let it be so taken from the ground as to preserve all the thread-like roots and replaced as soon as possible in the ground prepared for it, the roots being carefully spread out and the fine, soft soil everywhere brought into close contact with them.

Now, to make more clear the advantage of such a planting, it may be well to plant another tree in the way that trees are so commonly planted.

Let some ordinary workman be sent to bring a tree from the woods. He will probably, with three or four thrusts of his sharp spade, sever the main roots of the tree at about the distance of a foot from the stem and then wrench the tree from the ground, rudely breaking off what roots have not been cut already, and will bear off the tree with a triumphant feeling that he was stronger than its "plaguey roots." Then he will make a hole in the ground just large enough to permit him to crowd the lacerated roots into it, with much twisting and turning, and then, heaping upon them the hard, lumpy ground, he will stamp it upon the roots and consider the tree planted, as he will say, perhaps, "in less than no time." It would have been better, probably, if he had not spent even so much time as he has upon it, as the school children will be likely to see to their satisfaction before the summer is over; but they may also learn a lesson in tree planting worth the cost of the life of one tree. It has been stated recently, on good authority, as an illustration of improper planting, that of some hundred trees planted a few years ago on the streets near Morningside Park, New York, every one has died or been removed because of its diseased or dilapidated contion, and replaced by another.

Prof. J. T. Rothrock, forest commissioner of Pennsylvania, in reply to a request for some suggestions in regard to the most profitable observance of Arbor Day, sends the following, bearing on this subject, which is most timely:

> In my judgment, one of the most important factors in Arbor Day celebration is space. We have had but few Arbor Day celebrations as yet in this State; yet, as I go over the Commonwealth, I find that already the question presses, Where to plant next year's trees in many of our contracted school grounds? The fact is, we have nowhere in this country recognized as we should how important it is to have large areas attached to our schools. There should be room for all legitimate plays; ample space for a typical, well-grown specimen of each species of native tree. Then, there should be a nursery where each child could plant seeds and nuts of our trees and watch them sprout and push out of the ground and see by what steps they became trees.
>
> Furthermore, this school lot should not be the refuse land of a school district. It should be well situated, have abundant water, and as much variety of soil and exposure as possible. It is clear, if these suggestions have any value, that 5 acres is the least space that any country schoolhouse should have.
>
> It is time for us to recognize the fact that ground dedicated to educational purposes should be as sacred as if set apart for a church. We should look down the coming centuries in forming our plans for it, and anticipate and prepare for a time when mature oaks will transmit the love and traditions of the place from one generation to the next. The school located in such surroundings would soon come to be recognized as a valuable possession. It would be the one cheerful spot in which the whole community had an ownership, the place of deposit of the public library, and the place where the public meetings would be held.
>
> This may all seem utopian. But it is coming. The very hardest lesson for us all to learn is that the world moves faster than we do. More than this, it moves in spite of us, and the next century will probably not be very old before it has moved into a higher appreciation of the value of large and well-kept school grounds. Our successors will feel that space which is too small, and land that is too poor to attempt to raise a crop of grain upon, is also wholly inadequate to the larger work of raising a crop of vigorous, liberal-minded, law-abiding citizens upon.

PLANTING ON LAWNS AND IN PARKS.

After what has been said of planting on streets and school grounds little needs to be added in regard to tree planting on larger spaces, such as lawns, parks, and other open places. The same trees may be used in general, but no such restrictions being necessitated as in the case of street planting, the selection may be made from a greater number of trees. For example, trees whose beauty depends upon their branches starting near the ground, so that the tree will be a solid mass of verdure resting upon the earth's surface, are not appropriate for street planting, where the branches must all be so high from the ground as to admit of unimpeded passage under them. Many other trees also would be misplaced upon a street border which are well adapted for use on a lawn or other open space.

An old Maine homestead.

No such uniformity in size or habit of growth is necessary in the case of lawn or park plantations, as in roadside planting. Landscape effects are here to be sought, and in securing them there is no limit hardly in the choice of trees, except in their adaptation to the soil and climate of the place to be planted. Here, as in all cases of planting, the first choice of trees should be made from those which are indigenous to the locality. This being done, others may be brought from a distance for the sake of increasing variety, or on account of their special merits, care being

taken to procure them from localities corresponding as nearly as may be in climatic and soil conditions to the region where it is proposed to plant them.

AIDS TO SUCCESS IN PLANTING.

It will conduce much to success in planting if trees are procured from nurseries rather than from the woodlands or other uncultivated places. In the nursery grounds the soil is in a light and soft condition, and the trees as they grow are frequently transplanted. This occasions a dense root growth close to the stem, and it enables the tree to be taken from the ground with comparatively little danger of breaking the roots, and the replanting is also accomplished with the greater facility.

Another aid to success, that is, to secure a healthy and vigorous growth of trees, will be found in giving them an ample bed of deeply trenched and well-broken soil when the planting takes place; and if the soil is poor or of too hard and compact a character, by removing it and putting in its place a liberal supply of soil of better structure and abounding in plant food. The present labor and expense involved in doing this will be amply compensated by the appearance of the trees in the subsequent years of their growth. The chief dependence of trees for the promotion of their growth is a sufficient supply of water, out of the constituents of which their bodies are largely built up, and which is the vehicle by means of which the mineral food in the soil is conveyed to all parts of their structure.

It is more important, therefore, that the soil should be of proper physical structure than that it should abound in desirable mineral ingredients. If the soil is hard or clayey, so that water can not penetrate it readily, or if it is coarse-grained and very porous, so that water falling upon it sinks rapidly to the depths below, the roots of trees will fail to obtain such a supply of moisture as is needful for a vigorous growth. They will have but a feeble vitality. Hence the need of having a soil which is of such texture as readily to admit the rains which fall upon it and yet such as to prevent the water from rapidly passing out of reach of the roots. In proportion as the soil is fine it presents a larger surface of moisture to the minute roots of plants.

It will conduce to the proper supply of moisture also if the ground above the tree roots, especially at the first planting, is covered with a mulch of straw or litter of some sort which, by shielding it from sun and wind, will prevent the evaporation of moisture from the soil and to that extent increase the amount at the disposal of the trees. Few understand how much water is removed from the ground by the influence of the sun and winds, especially the latter. One of the chief difficulties in the way of securing a desirable tree growth in many parts of the country, particularly on the Western plains, arises from the prevalence of strong and often hot winds. In the existing forests the trees are protected from the effects of evaporation by the canopy of shade afforded by their leafy tops and by the mulch of fallen leaves accumu-

lated year by year at their base. Where there are not reasons forbidding it we can do nothing better to promote the healthful growth of the trees we plant than to allow the annual fall of leaves to remain upon the ground above the roots and thus form a perpetual mulch of protection for the trees.

METHOD OF PLANTING.

Little is necessary to be added to what has been said in different parts of this pamphlet as to the proper method of planting. The whole matter may be summed up by saying that a tree or plant should be taken from the ground with as little disturbance or impairment of its root system as possible and set in its new place of growth with such care as not to harm its roots, but to bring them all into close contact with the soil, by pressing it firmly around and upon them, thus giving them opportunity at every point to absorb from the particles of soil the moisture necessary for the steady and healthful growth of the tree, and leaving no vacant spaces to promote decay or lessen the supply of moisture. This is the most important thing to be secured. Care should be taken also in conveying the tree from the place from which it is taken to the place of planting not to allow the roots to become dry by exposure either to the sun or the wind. Especially should it be so in the case of evergreen trees, which have a resinous sap. If this sap becomes hardened by exposure to sun or wind, it is nearly impossible to restore its fluid condition so that it will perform its part in the circulatory system, and the tree may be considered dead already.

OPINIONS OF REPRESENTATIVE MEN.

The State of Nebraska having, a few years ago, made its Arbor Day to coincide with Mr. Morton's birthday, the editor of one of its newspapers issued, in 1888, a special Arbor Day number of his paper. Prominent among the features of that issue was a collection of letters received, in response to the editor's invitation, from a large number of persons distinguished in public life or otherwise, expressing their appreciation of Arbor Day and their regard for its author. It seemed that the sentiments therein expressed, which so justly set forth the merits and importance of Arbor Day, ought on that account to have a place in the present publication. Portions of a few of the many letters received are therefore inserted here:

I willingly confess so great a partiality for trees as tempts me to respect a man in exact proportion to his respect for them. He can not be wholly bad who has a sympathy with what is so innocent and so beautiful. But quite apart from any sentimental consideration, the influence of trees upon climate and rainfall gives to

the planting of trees, and to the protection of them where nature has already planted them, a national importance. Our wicked wastefulness and contempt for the teaching of science in this matter will most surely be avenged on our descendants. Nature may not instantly rebuke, but she never forgives, the breach of her laws.

I am glad, therefore, to join in this tribute of friendly gratitude to the inventor of Arbor Day. I think that no man does anything more visibly useful to posterity than he who plants a tree. I should answer the cynic's question, "What has posterity done for me that I should do anything for it?" by saying that it is all the pleasanter to do something for those who can do nothing for us.

Marco Polo relates that the great Kublai Khan planted trees the more willingly because "his astrologers and diviners told him that they who planted trees lived long." Let me hope that this may prove true in the case of Mr. Morton.—James Russell Lowell.

No instructed agriculturist is unacquainted with the ameliorating influence on climate, rainfall, freshet, windstorms, etc., produced by the liberal planting of trees on waste lands. The cheering thing has been that the same wise ideas have crept into the minds of our people and made them set resolutely to work in carrying out the simple, practical, and benignant suggestion of Mr. Morton.

An essay might be written on this topic by any thoughtful man acquainted with the phenomena of meteorology, and if Mr. Morton's plan shall be persevered in by the whole countay, nature herself will write that essay in beautiful style before a quarter of a century is passed.—George H. Boker.

The best and highest thing a man can do in a day is to sow a seed, whether it be in the shape of a word, an act, or an acorn. Last year, on less than half an acre of ground, at my summer home by the seaside at Hull, I planted 227 individual lives, of creeper, shrubs, and tree. All through the winter, from the city, my mind reached out, as it were, to observe and care for the young things in their strange soil. Last week I went to see them, and Mr. Morton will know the thrill of pleasure, unlike all other pleasures, which came from the signs of health and growth in the plants.—John Boyle O'Reilly.

It is not very long since, especially in the Eastern States, when the enemy of the tree was considered the friend of the human race, but the time has now come when the friend of the tree is the friend of the race.

Mr. Morton deserves the gratitude of the whole land. How many naked spots on this vast continent will be clothed in verdure by reason of his happy suggestion! The birds and animals, as well as the people, profit by his wise forethought. Every tree planted upon this day will serve to keep green his memory.—John Burroughs.

If, as has been wisely said, he is a public benefactor who causes two blades of grass to grow where only one grew before, we well may honor the man to whom his country will owe, in the near future, so many beautiful groves and orchards and trees, blessing with their shade its village streets.—J. T. Trowbridge.

Most of the States have sinking funds with which to provide for debts not yet due. It would be a simple and wise policy for a State to invest a considerable sum annually from its sinking fund in forest. Individuals hesitate about a form of investment which does not pay for many years. A State need not hesitate, because it does not need the money for many years. A State has also the power to make and enforce the laws which will protect its forests.—Edward Everett Hale.

The practice of systematic tree planting is a most excellent one, and those who have encouraged and promoted it deserve well of their country. I am very glad that the West has been roused to a sense of the importance of planting trees, and hope that all parts of the country will soon feel the necessity of preserving them.—Francis Parkman.

The material benefits of Arbor Day alone are incalculable, for it makes the barren land fertile and the desert plain green with beauty.

But these material benefits, great as they are, are small compared with the moral effect on the mind and heart of the people. In the young, especially, it enriches the taste, cultivates the love of beauty, and provides pleasant, healthful impressions that never will be obliterated. The love of trees, I think, has a more elevating effect than even the love of flowers; it is more strong and invigorating.

Besides all these immediate benefits, Arbor Day reaches far beyond the localities where it is observed. The young, gathered in certain sections, eventually become scattered and have homes of their own. The influence of this day will follow them there, and under the influence of their early cherished impressions trees will be planted, not only around their dwellings, but along the roads and water courses of the place in which they live, and thus cover the land with beauty and blessing.

All honor, then, to the founder of Arbor Day. The sculptor's art could not erect so noble a monument to his memory as loving hands and hearts are rearing and shall rear to it all over this barren land.—J. T. Headley.

All lovers of nature may well rejoice in the establishment of Arbor Day, and join in doing honor to the founder of an institution so beneficent.—Thomas Wentworth Higginson.

Whatever makes a village or town more attractive promotes that local pride and public spirit which are the vital and conservative forces of a great republic; and, if the planter of one shade tree is a public benefactor, what shall we say of him who stimulates the planting of whole groves and forests?—George William Curtis.

The observance of Arbor Day is aiding in bringing about a realization of the needs of our forestry interests, and will ultimately make the whole country equal to the occasion of a methodical, systematic forestry management.—B. E. Fernow.

Many people, often among the most intelligent, when they first hear of Arbor Day, look upon it as a kind of sentimental feast quite out of date in our matter-of-fact generation, but upon a closer inspection they soon discover its practical value.—H. G. Joly.

Prior to 1872 no system of forestry had been attempted in the United States. The spasmodic efforts of tree planting upon a small scale, with very rare exceptions, were attended with the most unsatisfactory results.

Forests were cut away without system and without thought of future condition or wants until it was self-evident that unless some judicious and comprehensive forest policy was adopted, this continent, once bristling with its primeval forests, would be permanently deprived of an element which constitutes a most important part in the economy of nature.

Forestry, no less than science, is a development of civilization. Colbert was instrumental in preventing the useless waste of the forests of the old world, but the honor of bequeathing to future generations an invaluable legacy of the perpetuation of forests was reserved for a philanthropist of a more advanced age.

There is no State in the Union but needs such a legacy, and when that which is now observed in twenty-eight States becomes a national holiday, then will each citizen have left to him and to his heirs forever, under a seal greater than that of Cæsar's, "private arbors and new-planted orchards."

If a John Howard, ameliorating the evils of convict life and alleviating the sufferings of prisoners, can be called the "world's philanthrepist," surely he who originates measures which tend directly to the improvement and fertility of the land and the wealth and comfort of the inhabitants, adding as many dollars to the world's exchequer as the mines of uncoined ore produce, and more rays to the brightness of the world's civilization than the electric spark has generated, is not least among fellow men.—A. J. Sawyer.

No man now living has done more to beautify and enrich his State and country than he. Millions upon millions of green and living monuments attest his forethought and his worth; and as these trees grow and expand in beauty, so will the love of this great benefactor increase in the hearts of our people.—John B. Peaslee.

The wisdom and pertinency of Jonathan Swift's saying may now well be recalled: "And he gave for his opinion that whoever could make two ears of corn or two blades of grass to grow on a spot of ground where only one grew before would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together."

If this were true of two ears of corn or blades of grass, how much more of a tree.—T. F. Bayard.

Tribute of fruits be his, and glossy wreaths
  From roadside trees, and his the people's love,
When east and west the wind of summer breathes
  Through orchard, shaded path, and sighing grove.
—[E. C. Stedman.

SUGGESTIONS FOR PROGRAMMES.

It is not necessary to give even a specimen programme for the observance of Arbor Day. If any attention to the subject is given beforehand a teacher can hardly fail to arrange a scheme of exercises that will be both interesting and profitable, and the pupils will not be slow to offer suggestions which will be worthy of consideration, and the more they are allowed to have a voice in the arrangements the more interested will they be in the actual doings of the day, and the more beneficial also will these be to them.

The exercises will naturally begin with the reading of the proclamation of the governor of the State or of the superintendent of public instruction, by which the day is fixed, or by the law setting apart the day for special uses. Any or all of these may be read. They will give dignity and impressiveness to the whole service. One or more selections from the Bible, indicating the high moral and religious lessons which the trees afford and the conspicuous place which they have in our sacred Scriptures, may fitly follow.

Other particular features of the Arbor Day exercises will be determined by the character of the school, the age of the pupils, the studies they are commonly engaged with, and various other considerations.

Teachers will bear in mind that the observance of Arbor Day has behind it a serious purpose, and that it is not simply an occasion for the children "to have a good time." It looks to their education in what is highest and noblest, to bring their minds into contact with the best thoughts of other minds, and kindle in them the purest and best feelings. It aims to open their hearts to the sweet and precious lessons which come from intercourse with nature, to make them unselfish, con-

siderate of one another and of all around them, and to prepare them to lead noble and useful lives.

In view of the duties of citizenship which are soon to devolve upon them care should be taken to make the patriotic feature of the exercises for Arbor Day prominent. Trees should be planted in memory of men who have nobly served their country. Patriotic songs should be sung, and the national flag should be displayed in the schoolhouse and on the march to plant the trees. Selections abounding in patriotic sentiments should also be read or recited. We have given a few specimens of appropriate character from various authors and have made reference to more, but the pupils should be encouraged to find others still.

The endeavor should be made to give the exercises a varied character, adapting them to the younger pupils not less than to the older. On this account songs and recitations of light and seemingly, perhaps, of somewhat trivial character may be allowed a place in company with those of higher grade. Let the youngest pupils become interested in Arbor Day as soon as possible, if it be only at first by songs of birds and flowers.

The programme for the day's observance will be imperfect if it does not include as one of its items an account given by some pupil of the object of Arbor Day, describing its origin and purpose, and the ends which are sought to be accomplished by it. This should be kept in mind by distinct reference to it from year to year.

In places so large that the schools can not well be combined in celebrating Arbor Day it will conduce to the greater interest and resulting benefit of the exercises if a generous rivalry is stimulated between the schools in the endeavor to see which will have the most interesting and pleasing programme.

Many schools have been accustomed to adopt by vote some tree as their emblematic tree or badge. This naturally causes the pupils to give special attention to that particular tree and on Arbor Day to make it the subject of essays, recitations, and songs, thus giving it the chief place in the exercises. The result may easily be made to be such a knowledge of that particular tree as will be pleasant and valuable for a lifetime. The choice of other trees in the same way from year to year will form a very pleasing method of learning to distinguish the various species of trees from each other and to know their habits and uses.

It is desirable that an address, or more than one, by some thoughtful person, invited for the occasion, should form a feature of the day's exercises. But the pupils should be expected to furnish essays for the occasion on appropriate subjects, and to prepare them carefully. There is given in this bulletin a considerable list of such subjects, but one by no means exhaustive, only suggestive of the many which readily offer themselves for consideration.

Then there is a large field for recitations and declamations appropriate for the day. A considerable number of such may be gathered from the essays in the earlier part of this publication, but our literature abounds with them, and teachers should encourage their pupils to become familiar with them, committing many of them to memory, thereby enriching their minds with gems of thought to be their delightful possession for life and a constant incentive to what is noblest, purest, and best.

MISCELLANEOUS READINGS.

We can hardly see or think of trees without being reminded of Mr. Lowell. He was eminently a lover of trees, and they were the inspiration of some of his best prose and poetry. This love of trees led him to call his pleasant place of residence, in Cambridge, "Elmwood." And no memorial of him would be more accordant with his own feelings than a growing tree. This is abundantly shown by the following letter, written only a few years ago, when it was proposed in one of our schools to plant on Arbor Day a tree in his memory:

"I can think of no more pleasant way of being remembered than by the planting of a tree. Like whatever things are perennially good, it will be growing while we are sleeping, and will survive us to make others happier. Birds will rest in it and fly thence with messages of good cheer. I should be glad to think that any word or deed of mine could be such a perennial presence of beauty, or show so benign a destiny."

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OF THE
UNIVERSITY
OF
CALIFORNIA

THE OAK.

What gnarled stretch, what depth of shade is his!
There needs no crown to mark the forest's king;
How in his leaves outshines full summer's bliss!
Sun, storm, rain, dew, to him their tribute bring,
Which he, with such benignant royalty
Accepts, as overpayeth what is lent;
All nature seems his vassal proud to be,
And cunning only for his ornament.

How towers he, too, amid the billowed snows,
An unquelled exile from the summer's throne,
Whose plain, uncinctured front more kingly shows,
Now that the obscuring courtier leaves are flown.
His boughs make music of the winter air,
Jeweled with sleet, like some cathedral front
Where clinging snowflakes, with quaint art, repair
The dents and furrows of Time's envious brunt.

How doth his patient strength the rude March wind
Persuade to seem glad breaths of summer breeze,
And win the soil that fain would be unkind,
To swell his revenues with proud increase!
He is the gem; and all the landscape wide
(So doth his grandeur isolate the sense)
Seems but the setting, worthless all beside,
An empty socket, were he fallen thence.

So, from oft converse with life's wintry gales,
Should man learn how to clasp with tougher roots
The inspiring earth—how otherwise avails
The leaf-creating sap that sunward shoots?
So every year that falls with noiseless flake
Should fill old scars up on the stormward side,
And make hoar age revered for age's sake,
Not for traditions of youth's leafy pride.

So, from the pinched soil of a churlish fate,
True hearts compel the sap of sturdier growth,
So between earth and heaven stand simply great,
That these shall seem but their attendants both;
For nature's forces, with obedient zeal
Wait on the rooted faith and oaken will,
As quickly the pretender's cheat they feel,
And turn mad Pucks to flout and mock him still.

Lord! all Thy works are lessons—each contains
Some emblem of man's all-containing soul;
Shall he make fruitless all Thy glorious pains,
Delving within Thy grace an eyeless mole?
Make me the least of Thy Dodona-grove,
Cause me some message of Thy truth to bring,
Speak but a word through me, nor let Thy love
Among my boughs disdain to perch and sing.

—[James Russell Lowell.

Live oak tree, Audubon Park, New Orleans, antedating the settlement of that country.

UNDER THE WILLOWS.

This willow is as old to me as life;
And under it full often have I stretched,
Feeling the warm earth like a thing alive,
And gathering virtue in at every pore
Till it possessed me wholly, and thought ceased,
Or was transfused in something to which thought
Is coarse and dull of sense. Myself was lost,
Gone from me like an ache, and what remained
Became a part of the universal joy.
My soul went forth, and, mingling with the tree,
Danced in the leaves; or, floating in the cloud,
Saw its white double in the stream below.

* * * * *

—[Lowell.

BENEATH THE SHADOW OF OAKS.

I thank heaven every summer's day of my life that my lot was humbly cast within the hearing of romping brooks, and beneath the shadow of oaks, and away from all the tramp and bustle of the world, into which fortune has led me in these latter years of my life. I delight to steal away for days and for weeks together, and bathe my spirit in the freedom of the old woods, and to grow young again lying upon the brookside, and counting the white clouds that sail along the sky, softly and tranquilly, even as holy memories go stealing over the vault of life.—Donald G. Mitchell.

QUALITY BETTER THAN QUANTITY.

Not merely growing like a tree
In bulk doth make man better be
Or standing long an oak three hundred years,
To fall a log at last, dry, bald and sear,
A lily of a day is fairer far in May.
Although it fall and die that night,
It was the plant and flower of light;
In small proportions we just beauties see
And in short measure life may perfect be.

—[Ben Jonson.

THE TASTE FOR TREES.

There is something noble, simple, and pure in a taste for trees. It argues, I think, a sweet and generous nature to have this strong relish for beauties of vegetation, and this friendship for the hardy and glorious sons of the forest. There is a grandeur of thought connected with this part of rural economy. It is worthy of liberal and freeborn and aspiring men. He who plants an oak looks forward to future ages, and plants for posterity. Nothing can be less selfish than this. He can not expect to sit in its shade nor enjoy its shelter, but he exults in the idea that the acorn which he has buried in the earth shall grow up into a lofty pile and shall keep on flourishing and increasing and benefiting mankind long after he shall have ceased to tread his paternal fields.—Washington Irving.

ACCORDANCE OF NATURE.

For Nature beats in perfect tune,
And rounds with rhyme her every rune,
Whether she work in land or sea,
Or hide underground her alchemy.
Thou cans't not wave thy staff in air,
Or dip thy paddle in the lake,
But it carves the bow of beauty there,
And the ripples in rhymes the oar forsake.
The wood is wiser far than thou;
The wood and wave each other know.
Not unrelated, unaffied,
But to each thought and thing allied,
Is perfect Nature's every part,
Rooted in the mighty Heart.

—[Emerson.

DOING GOOD.

When we plant a tree we are doing what we can to make our planet a more wholesome and happier dwelling place for those who come after us, if not for ourselves.—O. W. Holmes.

NOBILITY.

True worth is in *being*, not *seeming*,
In doing each day that goes by
Some little good—not in the dreaming
Of great things to do by and by.
—[Alice Cary.

THE BANK OF CONTENTMENT.

While I live, I trust I shall have my trees, my peaceful idyllic landscape, my free country life, at least half the year; and while I possess so much, * * * I shall own 100,000 shares in the Bank of Contentment.—Bayard Taylor.

TREES COMPOSITE BEINGS.

A tree is a composite being; a kind of community by itself. The leaves and limbs are all the time striving with each other to see which shall have the most room and the most sunshine. Each strives for all he can get. While some perish in the attempt, or meet with only very indifferent success, the strongest of the strongest buds survive. Each leaf helps to sustain the limb which carries it, and each limb furnishes some nourishment to the common trunk for the common welfare. The tax is always adjusted according to the ability of each to contribute. As the limbs of a tree are constantly striving for the mastery, so each bush and tree in grove or forest is striving with others for the mastery. The weakest succumb to the strongest; some perish early; some lead a feeble existence for many years, while even the strongest are more or less injured. With plenty of room, the trunk will be short, the branches many and widespread; where crowded, the lower limbs perish for want of light. Dead limbs fall to the ground to protect and enrich it for nourishing the surviving limbs and the trunk. The scars heal over, more limbs perish as new ones creep upward, and thus we find tall, clean trunks in a dense forest.—Anon.

TEACHING.

One impulse from a vernal wood
May teach you more of man,
Of moral evil and of good,
Than all the sages can.
—[Wordsworth.

OBSERVATION.

It is better to know the habits of one plant than the names of a thousand; and wiser to be happily familiar with those that grow in the nearest field than arduously cognizant of all that plume the isles of the Pacific or illumine the Mountains of the Moon.—Ruskin.

LEAF-TONGUES OF THE FOREST.

The leaf-tongues of the forest, the flower-
lips of the sod,
The happy birds that hymn their rapture in
the ear of God,
The summer wind that bringeth music over
land and sea,
Have each a voice that singeth this sweet
song of songs to me;
"This world is full of beauty, like other
worlds above
And if we did our duty, it might be full of
love." —[Gerald Massey.

LESSONS OF THE TREES.

I shall speak of trees as we see them, love them, adore them in the fields where they are alive, holding their green sunshades over our heads, talking to us with their hundred thousand whispering tongues, looking down on us with that sweet meekness which belongs to huge but limited organism—which one sees most in the patient posture, the outstretched arms, and the heavy drooping robes of these vast beings, endowed with life, but not with soul—which outgrow us and outlive us, but stand helpless, poor things, while nature dresses and undresses them.—Holmes.

●

IMPORTANCE OF FORESTS.

Keeping up a fit proportion of forests to arable land is the prime condition of human health. If the trees go, men must decay. Whosoever works for the forests works for the happiness and permanence of our civilization. A tree may be an obstruction, but it is never useless. Now is the time to work if we are to be blessed and not cursed by the people of the twentieth and twenty-first centuries. The nation that neglects its forests is surely destined to ruin.—Hon. Elizur Wright.

NATURE'S BOOK.

* * * * *

And Nature, the old nurse, took
The child upon her knee,
Saying: "Here is a storybook
Thy Father has written for thee."

"Come, wander with me," she said,
"Into regions yet untrod;
And read what is still unread
In the manuscripts of God."

And he wandered away and away
With Nature, the dear old nurse,
Who sang to him night and day
The rhymes of the universe.

And whenever the way seemed long,
Or his heart began to fail,
She would sing a more wonderful song,
Or tell a more marvelous tale.

* * * * *

—Longfellow—"The Fiftieth Birthday of Agassiz."

BEST GIFTS.

Gifts that grow are best;
Hands that bless are blest;
Plant: Life does the rest!
Heaven and earth help him who plants a tree,
And his work its own reward shall be.

—[Lucy Larcom.

SYMPATHY WITH TREES.

I care not how men trace their ancestry,
To ape or Adam; let them please their whim;
But I in June am midway to believe
A tree among my far progenitors,
Such sympathy is mine with all the race,
Such mutual recognition vaguely sweet
There is between us.

—[Lowell.

BRYANT, THE POET OF TREES.

"It is pleasant," as Mr. George W. Curtis has said, "to remember, on Arbor Day, that Bryant, our oldest American poet and the father of our American literature, is especially the poet of trees. He grew up among the solitary hills of western Massachusetts, where the woods were his nursery and the trees his earliest comrades. The solemnity of the forest breathes through all his verse, and he had always, even in the city, a grave, rustic air, as of a man who heard the babbling brooks and to whom the trees told their secrets."

His "Forest Hymn" is familiar to many, but it can not be too familiar. It would be well if teachers would encourage their pupils to commit the whole, or portions of it at least, to memory. Let it be made a reading lesson, but, in making it such, let pains be taken to point out its felicities of expression, its beautiful moral tone and lofty sentiment, and its wise counsels for life and conduct. Nothing could be more appropriate, especially for the indoor portion of the Arbor Day exercises, than to have this poem, or portions of it, read by some pupil in full sympathy with its spirit, or by some class in concert.

EXTRACT FROM BRYANT'S "FOREST HYMN."

Father, Thy hand
Hath reared these venerable columns; Thou
Didst weave this verdant roof. Thou didst look down
Upon the naked earth, and forthwith rose
All these fair ranks of trees. They, in Thy sun,
Budded, and shook their green leaves in Thy breeze,
And shot toward heaven. The century-living crow
Whose birth was in their tops, grew old and died
Among their branches, till, at last, they stood,
As they now stand, massy, and tall, and dark,
Fit shrine for humble worshiper to hold
Communion with his Maker. These dim vaults,
These winding aisles, of human pomp or pride
Report not. No fantastic carvings show
The boast of our vain race to change the form
Of Thy fair works. But Thou art here—Thou fill'st
The solitude. Thou art in the soft winds
That run along the summit of these trees
In music; Thou art in the cooler breath
That from the inmost darkness of the place
Comes, scarcely felt; the barky trunks, the ground,
The fresh, moist ground, are all instinct with Thee.

Here is continual worship. Nature, here,
In the tranquillity that Thou dost love,
Enjoys Thy presence. Noiselessly around,
From perch to perch, the solitary bird
Passes; and yon clear spring, that, 'midst its herbs,
Wells softly forth, and, wandering, steeps the roots
Of half the mighty forest, tells no tale
Of all the good it does. Thou hast not left
Thyself without a witness, in these shades,
Of Thy perfections. Grandeur, strength and grace
Are here to speak of Thee. This mighty oak –
By whose immovable stem I stand and seem
Almost annihilated—not a prince
In all that proud old world beyond the deep,
E'er wore his crown as loftily as he
Wears the green coronal of leaves with which
Thy hand has graced him. Nestled at his root
Is beauty such as blooms not in the glare
Of the broad sun. That delicate forest flower,
With scented breath and look so like a smile,
Seems, as it issues from the shapeless mold,
An emanation of the indwelling Life,
A visible token of the upholding Love,
That are the soul of this wide universe.

* * * * *

Be it ours to meditate
In these calm shades, Thy milder majesty,
And to the beautiful order of Thy works
Learn to conform the order of our lives.

—[Bryant.

BLESSING FOR THE TREE PLANTER.

O painter of the fruits and flowers!
We thank Thee for thy wise design
Whereby these human hands of ours
In nature's garden work with Thine.

* * * * *

Give fools their gold and knaves their power;
Let fortune's bubbles rise and fall;
Who sows a field or trains a flower
Or plants a tree is more than all.

For he who blesses most is blest;
And God and man shall own his worth
Who toils to leave as his bequest
An added beauty to the earth.

And, soon or late, to all who sow,
The time of harvest shall be given;
The flower shall bloom, the fruit shall grow,
If not on earth, at last in heaven.

—[Whittier.

GREAT CRYPTOMERIA AVENUE OF JAPAN.

The people of a certain locality in Japan, it is said, love to tell this story of what is perhaps the most beautiful road in the Japanese Empire. When the great general and lawgiver Iyeosasu died, his former tributary princes vied with one another in rich mortuary gifts to perpetuate his memory. One daimio, loving and loyal, instead of the customary gift of rare bronze or wrought stone to honor his dead lord, gave from his forest land thousands of cryptomeria trees, which he wisely knew would be an ever-growing delight for generations in a densely populated region.

These young trees, which were then but 18 inches or more in height, he planted at equal distances along the two roads leading to Nikko, where the body of the dead prince was interred. Two hundred years have passed, and the trees, so small when planted, are giants now, whose branches interlock across the wide roadway, presenting to the traveler in either direction a vista of green as far as the eye can reach. Extending for 30 miles in one direction, and for 20 miles in another, these rows of noble trees meet 7 miles from the temple where lie the ashes of the honored dead, and for this last 7 miles a double row of trees is found on each side of the roadway. In describing this unique and very beautiful tribute of respect and affection, a recent traveler says:

"Many who visit Nikko may forget the loveliness of the mountain scenery, the waterfalls and rushing streams, the carving and gilding of the temples, the soft, low tone of the bells, the odor of incense, and the chanting of priests, but few will forget their 20 miles' ride beneath the over-arching branches of the stately trees. What more beautiful memorial could be suggested than this, which benefits rich and poor, prince and coolie, alike, while mere bronze lanterns and costly but dead memorial stones are of no service except as reminders of a bygone age?"

These trees have been growing for two centuries; a half dozen generations have enjoyed their coolness, their beauty, refreshing to tired eyes and weary limbs, and they will be the delight of generations to come.—Prof. J. P. McCaskey.

AN APRIL DAY.

When the warm sun, that brings
Seedtime and harvest, has returned again,
'Tis sweet to visit the still wood, where springs
The first flower of the plain.

* * * * *

From the earth's loosened mold
The sapling draws its sustenance, and thrives;
Though stricken to the heart with winter's cold,
The drooping tree revives.

The softly warbled song
Comes from the pleasant woods, and colored wings
Glance quick in the bright sun, that moves along
The forest openings.

* * * * *

Sweet April! many a thought
Is wedded unto thee, as hearts are wed;
Nor shall they fail, till, to its autumn brought,
Life's golden fruit is shed.

—[Longfellow.

THE WOODS AND THE COURT.

In the forest of Arden, Shakespeare makes the banished duke say to his companions:

"Now, my co-mates and brothers in exile,
Hath not old custom made this life more sweet
Than that of painted pomp? Are not these woods
More free from peril than the envious court?
Here feel we but the penalty of Adam,
The seasons' difference; as the icy fang
And churlish chiding of the winter's wind,
Which, when it bites and blows upon my body,
Even till I shrink with cold, I smile and say:
'This is no flattery; these are counsellors
That feelingly persuade me what I am.'
Sweet are the uses of adversity; * * *

* * * * *

And this our life, exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in everything."

—[As You Like It, act 2, scene 1.

THE SPIRIT OF POETRY.

There is a quiet spirit in these woods,
That dwells where'er the gentle south wind blows;
Where underneath the white-thorn, in the glade,
The wild flowers bloom, or, kissing the soft air,
The leaves above their sunny palms outspread.
With what a tender and impassioned voice
It fills the nice and delicate ear of thought,
When the fast-ushering star of morning comes
O'erriding the gray hills with golden scarf;
Or when the cowled and dusky-sandaled Eve,
In mourning weeds, from out the western gate,
Departs with silent pace! That spirit moves
In the green valley, where the silver brook,
From its full laver, pours the white cascade;
And, babbling low amid the tangled woods,
Slips down through moss-grown stones with endless laughter.
And frequent, on the everlasting hills.
Its feet go forth, when it doth wrap itself
In all the dark embroidery of the storm,
And shouts the stern, strong wind. And here, amid
The silent majesty of these deep woods,
Its presence shall uplift thy thoughts from earth,
As to the sunshine and the pure, bright air,
Their tops the green trees lift. * * *

—[Longfellow.

SELECTIONS FOR RECITATIONS.

THE PURPOSE OF ARBOR DAY.

To avert treelessness; to improve the climatic conditions; for the sanitation and embellishment of home environments; for the love of the beautiful and useful combined in the music and majesty of a tree, as fancy and truth unite in an epic poem, Arbor Day was created. It has grown with the vigor and beneficence of a grand truth or a great tree.—J. Sterling Morton.

FOREST HYMN.

The groves were God's first temples. Ere man learned
To hew the shaft, and lay the architrave,
And spread the roof above them—ere he framed
The lofty vault, to gather and roll back
The sound of anthems; in the darkling wood,
Amidst the cool and silence, he knelt down,
And offered to the Mightiest solemn thanks
And supplication. For his simple heart
Might not resist the sacred influences
Which, from the stilly twilight of the place,
And from the gray old trunks that high in heaven
Mingled their mossy boughs, and from the sound
Of the invisible breath that swayed at once
All their green tops, stole over him, and bowed
His spirit with the thought of boundless power
And inaccessible majesty. Ah, why
Should we, in the world's riper years, neglect
God's ancient sanctuaries, and adore
Only among the crowd, and under roofs
That our frail hands have raised? Let me, at least,
Here, in the shadow of this aged wood,
Offer one hymn—thrice happy if it find
Acceptance in His ear.

* * * * * *

—[Bryant.

LEAVES.

The leaves of the herbage at our feet take all kinds of strange shapes, as if to invite us to examine them. Star-shaped, heart-shaped, spear-shaped, arrow-shaped, fretted, fringed, cleft, furrowed, serrated, sinuated, in whorls, in tufts, in spires, in wreaths, endlessly expressive, deceptive, fantastic, never the same from footstalk to blossom, they seem perpetually to tempt our watchfulness and take delight in outstripping our wonder.—Ruskin.

INFLUENCE OF NATURE.

Therefore am I still
A lover of the meadows and the woods
And mountains, and of all that we behold
From this green earth; of all the mighty world
Of eye and ear, both what they half create
And what perceive; well pleased to recognize
In nature, and the language of the sense,
The anchor of my purest thoughts, the nurse,
The guide, the guardian of my heart, and soul,
Of all my moral being.
—[Wordsworth.

THE FOREST A HERITAGE.

I regard the forest as an heritage, given to us by nature, not for spoil or to devastate, but to be wisely used, reverently honored, and carefully maintained. I regard the forest as a gift intrusted to us only for transient care during a short space of time, to be surrendered to posterity again as unimpaired property, with increased riches and augmented blessings, to pass as a sacred patrimony from generation to generation.—Baron Ferdinand von Mueller.

STEADFASTNESS.

A little of thy steadfastness,
Rounded with leafy gracefulness,
    Old oak, give me—
That the world's blasts may round me blow,
And I yield gently to and fro,
While my stout-hearted trunk below
    And firm-set roots unshaken be.
—[Lowell.

THE WASHINGTON ELM.

This tree still stands at Cambridge, Mass. It is on Garden street, a short distance from the colleges, and is a large, well-preserved tree. An iron fence is built around it, and on a stone in front is the following inscription: "Under this tree George Washington took command of the American Army, July 3, 1775."

Beneath our consecrated elm
    A century ago he stood,
    Famed vaguely for that old fight in the wood
Whose red surge sought, but could not overwhelm
The life foredoomed to wield our rough-hewn helm.

* * * * *

Firmly erect, he towered above them all,
The incarnate discipline that was to free
With iron curb that armed democracy.
—[Lowell—"Under the Old Elm."

WEALTH IN WOOD.

The true basis of national wealth is not gold, but wood. Forest destruction is the sin that has caused us to lose our earthly paradise. War, pestilence, storms, fanaticism, and intemperance, together with all other mistakes and misfortunes, have not caused half as much permanent damage as that fatal crime against the fertility of our Mother Earth.—Felix L. Oswald.

SUBJECTS FOR DECLAMATION

Character of Washington	**Thomas Jefferson**
Eulogium on Washington	**Daniel Webster**
Antiquity of Freedom	**Bryant**
Paul Revere's Ride	**Longfellow**
Story of Bunker Hill Battle	**O. W. Holmes**
The American Flag	**J. Rodman Drake**
Centennial Hymn	**Whittier**
Tribute to Abraham Lincoln	**J. R. Lowell**
Sheridan's Ride	**Read**
Song of Marion's Men	**Bryant**
Centennial Song	**Bayard Taylor**
America	**S. F. Smith**
The Flag of the Union	**George P. Morris**
Union and Liberty	**O. W. Holmes**

Other selections for recitation or declamation, a few out of the many, are the following:

A June Day	**Lowell: Sir Launfal**
Planting of the Apple Tree	**Bryant**
The Last Leaf	**Holmes**
Under the Greenwood Tree	**Shakespeare**
Among the Trees	**Bryant**
The Spirit of Poetry	**Longfellow**
Plant a Tree	**Lucy Larcom**
The Prairies	**Bryant**
Popular Poplar Tree	**Blanch W. Howard**
Woodman, Spare that Tree	**Morris**
The Ivy Green	**Dickens**
The Oak	**Lowell**
The Pine Tree	**Emerson**
Fair Tree	**Lady Winchelsea**
Hiawatha, extracts from	**Longfellow**
Landing of the Pilgrims	**Mrs. Hemans**
Love of Nature	**Wordsworth**
May Queen	**Tennyson**
Discourse on Trees	**Beecher**

TOPICS FOR ARBOR DAY ESSAYS.

Celebrated trees.
Short history of Arbor Day.
What Arbor Day is for.
How to plant a tree.
Best trees to plant.
The most useful tree.
Trees and their relation to birds.
Trees and their relation to fishes.
Varieties of trees on our farm.
Schoolhouses: What they are and what they should be.
Schoolgrounds: How to improve them.
What the leaves do.
Best trees to plant on the roadside.
Planting nut-bearing trees: Encouragement for it.
Best trees and shrubs for ornamental planting.
What to do with signs that are nailed to trees and fences and painted on the rocks.
How to do away with rubbish on the roadsides.
Advantages of good sidewalks.
Roads and walks, and how to make them.
How to make Arbor Day most useful.
Teaching of botany and horticulture in schools.

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U. S. DEPARTMENT OF AGRICULTURE.

ARBOR DAY:

ITS HISTORY AND OBSERVANCE.

BY

N. H. EGLESTON.

[Revised Edition.]

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LETTER OF SUBMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
Washington, D. C., January 29, 1896.

SIR: I have the honor to submit the accompanying bulletin on Arbor Day, prepared by your direction.

Its aim is to give an authentic account of the origin, history, and uses of the day—now observed throughout our country and also in other lands—which has been regarded with interest by the Department ever since its observance began, and to offer such suggestions and helps as may serve to increase its usefulness.

It is impossible to sketch the history of Arbor Day in even the briefest manner without frequent reference to the present Secretary of the Department, with whom the day is so intimately connected. If the writer of this bulletin had felt at liberty to disregard the restraints imposed by the official character of the work, a much more frequent mention of Mr. Morton's name would have been the result.

Some of the illustrations in the bulletin, especially those of leaves, are from Apgar's Trees of the Northern United States, copyright, 1892, by the American Book Company, to whom thanks are due for permission to use them, it having been found impracticable to prepare original figures of this character without delaying the bulletin until after the arrival of the time set apart in many States for the observance of Arbor Day. Similar thanks are due to others also for like favors.

I take occasion here also to thank the superintendents of public instruction and others who have so readily and courteously responded to my invitation and rendered aid, by suggestion or otherwise, in the preparation of this publication. Wherever material from such or other sources has been incorporated in these pages I have endeavored to give credit to the respective authors. For the rest the writer is responsible.

Respectfully,

N. H. EGLESTON.

Hon. CHAS. W. DABNEY, Jr.,
Assistant Secretary.

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INTRODUCTION.

Arbor Day, from being only a humble expedient of one of our Western States a few years ago, has become a national holiday and one of our important institutions. Its original design has been modified since its observance has become associated with our schools. It is now not only a day for tree planting for economic and æsthetic purposes, but its observance has been made the means of securing much valuable knowledge in regard to plant and tree life, of cultivating in the young the powers of observation, and kindling in their minds an interest in natural objects which will be a lifelong source of benefit and pleasure.

Is it too much to hope, also, that this Arbor Day festival, engaging our children in its observance so generally and so pleasantly with songs, recitations, and the planting of trees and shrubs around the schoolhouses and along the streets or in public parks and other places, may have the effect of developing in coming generations a keener appreciation of the value and the beauty of trees than has hitherto been felt in our country, and that thus the reckless destruction of our forests, now going on with such threatening consequences, may be arrested before the calamities are upon us which have befallen other countries through the loss of their trees?

ARBOR DAY: HISTORY AND OBSERVANCE.

COMMERCIAL VALUE OF TREES.

Arbor Day has its abundant justification in the surpassing value of trees from whatever point of view they are considered. Their beauty is felt by all. Nothing contributes so much to make the world a pleasant place of abode for man. Just as anyone has the true home feeling and seeks to create a home for himself, he seeks the trees as being an indispensable aid in the accomplishment of his purpose. He must have the trees around his dwelling place. He must have their shelter and their shade, their beauty of form, of leaf, and blossom, and fruit, their ever-varying aspect with every change of earth and sky, of sunshine and cloud. In short, he must have their companionship in his daily life. But looked at apart from all such feeling and sentiment, looked at not in their living but in their dead state, looked at as mere lumber or material for man's constructive purposes, for the thousand uses of daily life, the trees have an almost incomparable value. Estimated by their money value alone the products of the forest exceed those from almost any other source.

We speak of the "precious metals," gold and silver; and they are so precious in the esteem of most persons that multitudes are ready to forsake all other occupations and rush in pursuit of them wherever they may be found or there is even a faint hope of finding them. Now we give to the hunters of these precious metals special privileges in the prosecution of their quest such as are not given to people engaged in other employments. It would seem that the mining of gold and silver is the most important interest of the country. It certainly holds a very prominent position in the public estimation.

But the last report of the Director of the Mint gives the value of the product of the gold and silver mines of the United States for the year 1894 as follows: Gold, $39,500,000; silver, $31,422,000; total, $70,922,000. At the same time, the most recent and careful estimates of the value of

the products of our forests during the same year make it $1,058,650,859, or fifteen times that of gold and silver.

Another comparison is very significant. If we add to the gold and silver products that of all other minerals, including such prominent ones as iron, copper, lead, zinc, coal, lime, natural gas, petroleum, salt, slate, building stones, and the twenty-five or more remaining, which are less important, we shall have for the value of all our mineral products obtained during the year 1894, $553,352,996, or only about one-half the value of our forest products.

Again, we may make a comparison in a different direction and with no less striking results. The statistical report of the Department of Agriculture gives the value of our cereal crops for the year 1894 as follows:

Wheat	$225, 902, 025
Corn	554, 719, 162
Oats	214, 816, 920
Rye	13, 395, 476
Barley	27, 134, 127
Buckwheat	7, 040, 238
Total	1, 043, 007, 948

or less by $15,000,000 than our one forest crop.

Is it not worth our while, therefore, to perpetuate if possible such a crop, and to guard against anything which threatens to diminish it? Ought we not, by every means within our control, to see that the source of this most valuable supply is not lessened in its capability of yielding such a preeminently valuable contribution to our welfare and comfort?

The need of tree planting, looked at in the wide view, results from the fact that we have been and are depleting our forest area at an unreasonable rate. The spread of population into the great treeless plains beyond the Mississippi has made a largely increased demand for lumber, and in response to that demand we have been for years consuming our forests at a rate far beyond the supply furnished by their annual growth. The best estimates make the annual consumption of our forests, for fuel and lumber chiefly, 25,000,000,000 cubic feet. To furnish this amount would require the produce of the annual growth of 1,200,000,000 acres of woodland, whereas our total forest area is less than 500,000,000 acres, which is no more than we need as a permanent stock of woodland for the country. It will be seen, then, that more than half of our annual consumption is a draft by so much upon our forest capital, when we should be only drawing from the forests the amount of their annual growth, or the interest of that capital. How long would it take a millionaire to become a bankrupt if he should be annually trenching upon his money capital at a like rate?

Few persons realize the enormous and often wasteful—that is, unnecessary—consumption of our forests. That consumption amounts

to 350 cubic feet per capita, as against 12 to 14 cubic feet per capita in Great Britain and about 40 cubic feet in Germany.

Some specifications may help us to apprehend the situation. Our railroads consume, on an average, annually for their construction 500,000,000 cubic feet of our very best timber. Our mines use for internal props and for the reduction of their ores immense amounts. One mine may be taken as an illustration. The Anaconda Mining Company, of Montana—well named Anaconda, in view of its enormous capacity for swallowing the forests whole, as it were—made a statement four years ago, now on file in one of the Departments of the Government, from which it appears that during a period of six months it consumed 65,000 cords of wood and 18,500,000 feet of lumber. At the same time the company stated that its daily consumption hereafter would be, wood 700 cords, lumber 100,000 feet, and its consumption for the year 1892 would be, wood 255,000 cords, lumber 40,000,000 feet. This lumber is mostly in the form of timber used as mine props.

Most of the wood and timber used by this and other mines in the Rocky Mountain and other western regions is cut from the public lands. Such is the indulgence shown by the Government that those engaged in mining or even prospecting for mines are allowed to cut and consume the timber on the public lands free of cost and with only such restrictions as may be made by the Secretary of the Interior. These restrictions are not close or narrow in character, and are easily evaded if not absolutely ignored, and so are to a great extent practically inoperative. The scanty appropriations of Congress do not allow the Secretary of the Interior to retain a sufficient number of inspectors to watch the immense extent of territory occupied by the forests and take notice of the depredations which may be made upon them, and even when depredations are occasionally discovered it is very difficult to secure a conviction and inflict the penalty prescribed for the offense.

To show the extent of these depredations and the scale on which the forests are consumed, may be instanced the case of one mining company in Dakota against which the Government has brought suit for the sum of $688,000, this being the alleged value of the trees cut less than 8 inches in diameter, which restriction had been placed upon the permit to cut. What must have been the number and value of the larger trees cut and consumed by this company? The operations of the Anaconda Company are carried on upon so large a scale that it is said they refuse to make a contract for less than 40,000 cords of wood in any single case, and their contracts range from that amount to 200,000 cords, while nearly 1,000,000 cords are constantly kept on hand. The company held last year a permit from the Secretary of the Interior to cut from four sections of public land within twelve months 14,000,000 feet of timber. The great Comstock Lode of Nevada is, if possible, a greater anaconda, whole mountains of forest having gone into its capacious

maw, the growth of two or three centuries having been swept away in a few years.

Figures are impotent to give one a full apprehension of the work of forest destruction that is wrought by these and other mining companies and the lumbering establishments which help them to their supplies. One needs to see with his own eyes the work as it is going on and the track of desolation which it leaves, to have an adequate notion of the destruction thus accomplished. One company, miscalled a development company, which is one of the agencies through which the Anaconda secures its supplies, has a daily capacity of 120,000 feet of timber.

It is to be considered also that not only the consumption of the forests incidental to mining operations but that resulting from ordinary lumbering is marked by great wastefulness. We throw away often more material than we use. A great portion of the substance of the trees cut in the forests is left there to decay or to be consumed by the flames. It is estimated that on the average not more than three-eighths of what we cut in the forests is utilized, five-eighths of the material being wasted. In the great redwood forests of the Pacific Coast such is the wasteful method of operation, it is said, that in procuring a railroad tie worth 35 cents, $1.87 worth of the substance of the tree is wasted. In Europe it is estimated that seven-eighths of the forest material is made use of and the waste is only one-eighth.

A conspicuous case of wastefulness is worth noting in this connection, not only as an instance of wastefulness, but for the great and direct damage resulting from it. To meet the demands of a great mining company on one of the Sierra Nevada ranges a band of men, numbering thousands in all, were sent with their axes into a forest district in that vicinity. It was an extensive region and the forest presented a stand of trees not excelled, perhaps, in quality in all the country. Every condition of climate and soil had been favorable for their growth. They stood thick and stalwart.

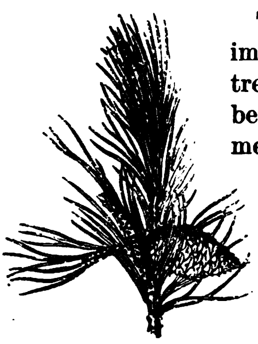
As the quickest and easiest way of getting out the largest trees, which were the ones wanted for the miners' use, the forest was cut clean and leveled with the ground. Then, the timber having been removed, the remaining trees, spread over miles and miles of the mountain side, were given to the flames. The fire not only consumed the trees, but burned up the soil beneath them—the rich leaf mold, which was the accumulation of centuries of tree growth. The very rocks beneath it were so heated by the mighty mass of burning fuel that, in many places, they crumbled to gravel. When the rains came and the snows melted rapidly in springtime—having no sheltering foliage of the trees to protect them from the rays of the sun—the ashes of the burned trees, and what was left of the soil, together with the rocky gravel, were swept down the mountain side with torrent swiftness and force, overflowing the banks of the water courses, tearing

them from their places, and pouring out the débris of disintegrated rock upon the fertile meadows below to the depth of many feet.

The settlers in the peaceful valleys at the foot of the mountains, to whom the dense forests had sent from their saturated spongy soil and the slowly melting snows under their protecting shade a steady and sufficient supply of water to enable them to prosecute their farming operations in that arid region with an assurance of success nowhere surpassed, now found themselves at the mercy of torrents in the spring season and droughts in the summer time, and were forced to abandon their no longer productive farms. Those green mountain slopes which it had taken centuries of growth to prepare as the guarantee of fertility to the fields below are gone. Naked rocks only are now to be seen in their place. It will take centuries to clothe them again with trees, and meanwhile the valleys and plains below will remain the desert which the greed and recklessness of man have created there.

With the enormous consumption of our forests now going on and rapidly increasing and the consequent diminution of our forest area, the need of tree planting becomes greater with every passing year, and the importance of Arbor Day constantly increases. Its great value, as has been said, is not so much in the number of trees planted on Arbor Day as in the tree sentiment created and stimulated by the Arbor Day observances, which will be helpful in arresting the wasteful destruction of our forests and lead on in due time, it is to be hoped, to all private and public tree planting which our interests demand.

ORIGIN AND HISTORY OF ARBOR DAY.



The first to call attention in this country, in an impressive way, to the value and absolute need of trees—their value not merely on account of their beauty or their adaptation for purposes of ornamental planting and mechanical utility, but for their connection as forests with climatic influences, with the flow of streams, and their consequent connection with the large interests of agriculture and commerce, in short, with the general welfare of all classes of people—was that eminent scholar and wise observer, Mr. George P. Marsh, for many years our worthy representative at the courts of Italy and Turkey. His residence in those older countries was calculated to draw his attention to the subject as it would not have been drawn had he always lived in his native land.

Ours was a remarkably well-wooded country. From Maine to the Gulf and from the Atlantic coast to the Alleghanies stretched an almost continuous forest, which at the beginning of white settlements

here and long afterwards was an impediment to agricultural development. The pioneer was obliged to clear a space among the trees to make room in which to cultivate his crops, and it is a significant sign of that early condition of things that the coat-of-arms of one of our States bears the emblem of a sturdy yeoman with uplifted ax. Under such circumstances, it is no wonder that the people of this country in former time had no very favorable estimate of trees and little appreciation of their value, except for fuel and the supply of timber for house building and certain other uses, or that they were willing that their consumption by the ax should be aided and accelerated by forest fires. Comparatively few persons until a recent period realized the serious inroads which, with a rapidly increasing population, had been made upon our forest resources or apprehended the dangers which were threatening us in the future as the consequences thereof.

In Europe Mr. Marsh found the Governments of Italy and Germany, as well as those of other countries, making active endeavors and at great expense to rehabilitate their forests which had been depleted centuries before, to guard them from depredation and, instead of leaving them to be consumed at the bidding of personal greed or recklessness, cherishing them as among their most precious possessions. He found the forests regarded as the most valuable crop which the ground can produce, and every effort made to stimulate their growth to the utmost. He found schools, of a grade corresponding to our colleges, established for the special purpose of training men for the successful planting and cultivation of forests. He found the growth of trees in masses and their maintenance reduced to a science and the management of the woodlands constituting one of the most important departments of state.

Such discoveries were well calculated to fix his attention upon the very different condition of the forests in his own country, and to convince him that the reckless destruction of them then going on here, if not checked, would bring upon this land the same calamities which had befallen countries of the Old World in past centuries, and from which only the most enlightened nations of Europe are now recovering through the arduous efforts of many decades, and at great pecuniary cost. The result of Mr. Marsh's observations was the publication of a volume entitled "The Earth and Man," and that admirable chapter in it on "The woods," to which, more than to any other source perhaps, we are indebted for the awakening of attention here to our destructive treatment of the forests, and the necessity of adopting a different course if we would avert most serious consequences, threatening more than anything else, possibly, our material welfare.

Other thoughtful and observing men at home became aware from time to time that we were wasting our tree heritage, and in one way or another they were urging the necessity of caution and economy in the treatment of the forests. It is remarkable, indeed, that as early as the colonial period some of our States—New Hampshire and New York, for

example—became somewhat alarmed by the inroads which were even then being made upon their forests, and made enactments for their protection. This action was exceptional, however, and little was done to draw attention to the rapid and dangerous depletion of our forests and awaken public sentiment on the subject until within the comparatively recent period of which we have just spoken.

For the purpose of securing a supply of timber for naval construction the Government, at the beginning of the present century, purchased certain tracts of live-oak timber, and about twenty-five years later, by an act of Congress, the President was authorized to take measures for their preservation. About the same time the Massachusetts Society for Promoting Agriculture offered prizes for forest planting, and thirty years later the State ordered a survey of her timber lands. Thirty years later still, acts began to be passed for the encouragement of timber planting, chiefly in the treeless Western States. The well-known timber-culture act was one of these. It made a free gift of the public lands to the successful planter of forest trees on one-fourth of his entry.

About twenty years ago the subject of forest destruction and its detrimental results came before the American Association for the Advancement of Science for consideration, and as the result of its discussions the association memorialized Congress, asking that measures be taken for the protection of the public timber lands. In consequence of this, a committee of the House of Representatives was appointed for the purpose of considering the establishment of a forestry department of the Government, and two years later the Commissioner of Agriculture was authorized to appoint a forest commissioner, which was the foundation of the present Forestry Division in the Department of Agriculture. The commissioner, the late Dr. F. B. Hough, made protracted inquiries into the condition of the forests in this country and in Europe, and published a voluminous report on the subject, which is altogether the most complete and valuable publication on forestry which has appeared in this country.

It was at about this time, or a few years earlier, that a practical movement was inaugurated by the present Secretary of Agriculture, the Hon. J. Sterling Morton, which has done more for the protection of our forests and the encouragement of tree planting than all our legislation. This was the establishment of Arbor Day, or tree-planting day. It was the happy thought of this pioneer settler on the treeless plains of Nebraska, who knew and felt the value of trees about the home, as well as their importance for the many uses of life, to enlist his neighbors and his fellow settlers throughout the State, by a common impulse, growing out of common wants and feelings, in the work of tree planting on one and the same given day. The wise suggestion was brought before the State board of agriculture in the form of a resolution designating a certain day for the inauguration of the tree-planting movement. The resolution was readily adopted. The appeal to the popular feeling and

the popular need was heartily responded to, and it was reported that many millions of trees were planted that year in Nebraska. This successful inauguration of Arbor Day led to its institution the same year by the horticultural society in Iowa, to be followed quickly by its adoption in Minnesota, Ohio, and other Western States.

A few years later Arbor Day assumed a new character and acquired a wider interest with the people as it became connected in its observance with the public schools. This it did for the first time during the sessions of a national forestry convention at Cincinnati in the year 1882. The sessions of the convention were continued through five days, on one of which there was a public parade, civic and military, with a march to Eden Park, where groves were planted and single trees in memory of distinguished men—poets, orators, governors, and others. The school children and their teachers formed a conspicuous feature of the pageant and the planting of the trees was done principally by them. Tree planting thus became a festivity, combining at once pleasure and utility. That Cincinnati observance was an object lesson for the country, as the report of it was published far and wide.

A national forestry association was formed at the time of the Cincinnati convention, and at its meeting in St. Paul the following year a resolution was adopted favoring the observance of Arbor Day by the schools of the country. A standing committee on Arbor Day was also appointed, and such a committee has been appointed at nearly every annual meeting of the association. Wherever since then Arbor Day has been adopted its observance has been connected with the schools, as it has been also in the States where it had been established before. Thus it has become a school festival, as it has also become a national one. It was only what might have been expected, therefore, that at the meeting of the National Education Association, at Saratoga, in July, 1892, when the subject had been brought to its attention by the Hon. B. G. Northrop. the committee to whom it was referred should report as follows:

> Your committee reports with pleasure that Arbor Day is now observed in accordance with legislative act, or annual public proclamation, in forty States and Territories. We recommend that the observance be universal, that village and district improvement associations be formed, that memorial trees be planted, and that appropriate means be employed to inspire in pupils and parents the love of beauty and a desire for home and landscape adornment.

Arbor Day is educational in the best and largest sense. By engaging the pupils of the schools in the study of trees, not merely from books but by actual observation and handling of them in their living state, the observing faculties of the pupils are appealed to and cultivated, and their minds are easily led on from the study of trees to that of shrubs and flowering plants and all natural objects. There can be no better training than this. It forms one of the best equipments for success in life in whatever employments one may be engaged, and is a

never-failing source of enjoyment. No studies are more wholesome than those of natural objects. They are suggestive of only what is good. They cultivate the sense and love of the beautiful everywhere. They meliorate the nature within us and fit us to be associates with one another, and to become worthy members of society wherever we may be.

And so Arbor Day and its public observance, taken with the studies connected with it, has led on naturally to the formation of town and village improvement societies and various other associations and organizations for the promotion, in one way and another, of the public welfare. The spirit of Arbor Day is benevolent. Its aim is the public good in some form, and it has a wide outlook. There is nothing narrow or selfish about it. If it plants trees, it is not for the benefit of any individual alone, but for all who may see them and have the benefit of them, whether soon or centuries hence. It plants for those who are to come, as well as for those now living.

Arbor Day is the one festival or celebration which, instead of looking backward and glorifying the heroes and achievements of the past or recounting the praises of present enterprises or actors, looks forward and seeks to make a better environment and a better inheritance for the coming generations. Its spirit is hopeful. Its motto is progress. It is ever reaching out for new acquisitions of knowledge, and seeking to impart new and more widespread benefits.

It is not a matter for wonder, therefore, that an institution with such a spirit and such possibilities, with so much to commend it to the attention of persons of intelligence and generous feeling, and especially to the ardent natures of the young, should have a speedy and wide acceptance. And so, by its own manifest merit and without any proppagandism on its behalf, it has been adopted by nearly every State and Territory of the Union; and limited by no national boundaries, it has even crossed the Atlantic on the one hand, and become established in Great Britain, France, and northern and southern Africa, and during the present year in Spain, and on the other, has crossed the Pacific and been welcomed in the Hawaiian Islands and in Japan.

The beneficent results of an institution of this character, and already almost world-wide in its reach, no one can measure. Year by year it will bring millions of people, young and old, into a closer and more intimate contact with nature, unveiling to them its precious secrets, opening to them stores of valuable knowledge, and cultivating in them the best feelings. In our own country it promises to do more than anything else to convert us from a nation of wanton destroyers of our unparalleled heritage of trees to one of tree planters and protectors. Instead of looking upon the trees with indifference, or even with a hostile feeling, as to a great extent we have done, or regarding them chiefly as material for use in the constructive arts or to be consumed as fuel, we shall become tree lovers. A tree sentiment will be created and established which will lead us to recognize and cherish the trees as

INTRODUCTION.

Arbor Day, from being only a humble expedient of one of our Western States a few years ago, has become a national holiday and one of our important institutions. Its original design has been modified since its observance has become associated with our schools. It is now not only a day for tree planting for economic and æsthetic purposes, but its observance has been made the means of securing much valuable knowledge in regard to plant and tree life, of cultivating in the young the powers of observation, and kindling in their minds an interest in natural objects which will be a lifelong source of benefit and pleasure.

Is it too much to hope, also, that this Arbor Day festival, engaging our children in its observance so generally and so pleasantly with songs, recitations, and the planting of trees and shrubs around the schoolhouses and along the streets or in public parks and other places, may have the effect of developing in coming generations a keener appreciation of the value and the beauty of trees than has hitherto been felt in our country, and that thus the reckless destruction of our forests, now going on with such threatening consequences, may be arrested before the calamities are upon us which have befallen other countries through the loss of their trees?

ARBOR DAY: HISTORY AND OBSERVANCE.

COMMERCIAL VALUE OF TREES.

Arbor Day has its abundant justification in the surpassing value of trees from whatever point of view they are considered. Their beauty is felt by all. Nothing contributes so much to make the world a pleasant place of abode for man. Just as anyone has the true home feeling and seeks to create a home for himself, he seeks the trees as being an indispensable aid in the accomplishment of his purpose. He must have the trees around his dwelling place. He must have their shelter and their shade, their beauty of form, of leaf, and blossom, and fruit, their ever-varying aspect with every change of earth and sky, of sunshine and cloud. In short, he must have their companionship in his daily life. But looked at apart from all such feeling and sentiment, looked at not in their living but in their dead state, looked at as mere lumber or material for man's constructive purposes, for the thousand uses of daily life, the trees have an almost incomparable value. Estimated by their money value alone the products of the forest exceed those from almost any other source.

We speak of the "precious metals," gold and silver; and they are so precious in the esteem of most persons that multitudes are ready to forsake all other occupations and rush in pursuit of them wherever they may be found or there is even a faint hope of finding them. Now we give to the hunters of these precious metals special privileges in the prosecution of their quest such as are not given to people engaged in other employments. It would seem that the mining of gold and silver is the most important interest of the country. It certainly holds a very prominent position in the public estimation.

But the last report of the Director of the Mint gives the value of the product of the gold and silver mines of the United States for the year 1894 as follows: Gold, $39,500,000; silver, $31,422,000; total, $70,922,000. At the same time, the most recent and careful estimates of the value of

the products of our forests during the same year make it $1,058,650,859, or fifteen times that of gold and silver.

Another comparison is very significant. If we add to the gold and silver products that of all other minerals, including such prominent ones as iron, copper, lead, zinc, coal, lime, natural gas, petroleum, salt, slate, building stones, and the twenty-five or more remaining, which are less important, we shall have for the value of all our mineral products obtained during the year 1894, $553,352,996, or only about one-half the value of our forest products.

Again, we may make a comparison in a different direction and with no less striking results. The statistical report of the Department of Agriculture gives the value of our cereal crops for the year 1894 as follows:

Wheat	$225,902,025
Corn	554,719,162
Oats	214,816,920
Rye	13,395,476
Barley	27,134,127
Buckwheat	7,040,238
Total	1,043,007,948

or less by $15,000,000 than our one forest crop.

Is it not worth our while, therefore, to perpetuate if possible such a crop, and to guard against anything which threatens to diminish it? Ought we not, by every means within our control, to see that the source of this most valuable supply is not lessened in its capability of yielding such a preeminently valuable contribution to our welfare and comfort?

The need of tree planting, looked at in the wide view, results from the fact that we have been and are depleting our forest area at an unreasonable rate. The spread of population into the great treeless plains beyond the Mississippi has made a largely increased demand for lumber, and in response to that demand we have been for years consuming our forests at a rate far beyond the supply furnished by their annual growth. The best estimates make the annual consumption of our forests, for fuel and lumber chiefly, 25,000,000,000 cubic feet. To furnish this amount would require the produce of the annual growth of 1,200,000,000 acres of woodland, whereas our total forest area is less than 500,000,000 acres, which is no more than we need as a permanent stock of woodland for the country. It will be seen, then, that more than half of our annual consumption is a draft by so much upon our forest capital, when we should be only drawing from the forests the amount of their annual growth, or the interest of that capital. How long would it take a millionaire to become a bankrupt if he should be annually trenching upon his money capital at a like rate?

Few persons realize the enormous and often wasteful—that is, unnecessary—consumption of our forests. That consumption amounts

to 350 cubic feet per capita, as against 12 to 14 cubic feet per capita in Great Britain and about 40 cubic feet in Germany.

Some specifications may help us to apprehend the situation. Our railroads consume, on an average, annually for their construction 500,000,000 cubic feet of our very best timber. Our mines use for internal props and for the reduction of their ores immense amounts. One mine may be taken as an illustration. The Anaconda Mining Company, of Montana—well named Anaconda, in view of its enormous capacity for swallowing the forests whole, as it were—made a statement four years ago, now on file in one of the Departments of the Government, from which it appears that during a period of six months it consumed 65,000 cords of wood and 18,500,000 feet of lumber. At the same time the company stated that its daily consumption hereafter would be, wood 700 cords, lumber 100,000 feet, and its consumption for the year 1892 would be, wood 255,000 cords, lumber 40,000,000 feet. This lumber is mostly in the form of timber used as mine props.

Most of the wood and timber used by this and other mines in the Rocky Mountain and other western regions is cut from the public lands. Such is the indulgence shown by the Government that those engaged in mining or even prospecting for mines are allowed to cut and consume the timber on the public lands free of cost and with only such restrictions as may be made by the Secretary of the Interior. These restrictions are not close or narrow in character, and are easily evaded if not absolutely ignored, and so are to a great extent practically inoperative. The scanty appropriations of Congress do not allow the Secretary of the Interior to retain a sufficient number of inspectors to watch the immense extent of territory occupied by the forests and take notice of the depredations which may be made upon them, and even when depredations are occasionally discovered it is very difficult to secure a conviction and inflict the penalty prescribed for the offense.

To show the extent of these depredations and the scale on which the forests are consumed, may be instanced the case of one mining company in Dakota against which the Government has brought suit for the sum of $688,000, this being the alleged value of the trees cut less than 8 inches in diameter, which restriction had been placed upon the permit to cut. What must have been the number and value of the larger trees cut and consumed by this company? The operations of the Anaconda Company are carried on upon so large a scale that it is said they refuse to make a contract for less than 40,000 cords of wood in any single case, and their contracts range from that amount to 200,000 cords, while nearly 1,000,000 cords are constantly kept on hand. The company held last year a permit from the Secretary of the Interior to cut from four sections of public land within twelve months 14,000,000 feet of timber. The great Comstock Lode of Nevada is, if possible, a greater anaconda, whole mountains of forest having gone into its capacious

maw, the growth of two or three centuries having been swept away in a few years.

Figures are impotent to give one a full apprehension of the work of forest destruction that is wrought by these and other mining companies and the lumbering establishments which help them to their supplies. One needs to see with his own eyes the work as it is going on and the track of desolation which it leaves, to have an adequate notion of the destruction thus accomplished. One company, miscalled a development company, which is one of the agencies through which the Anaconda secures its supplies, has a daily capacity of 120,000 feet of timber.

It is to be considered also that not only the consumption of the forests incidental to mining operations but that resulting from ordinary lumbering is marked by great wastefulness. We throw away often more material than we use. A great portion of the substance of the trees cut in the forests is left there to decay or to be consumed by the flames. It is estimated that on the average not more than three-eighths of what we cut in the forests is utilized, five-eighths of the material being wasted. In the great redwood forests of the Pacific Coast such is the wasteful method of operation, it is said, that in procuring a railroad tie worth 35 cents, $1.87 worth of the substance of the tree is wasted. In Europe it is estimated that seven-eighths of the forest material is made use of and the waste is only one-eighth.

A conspicuous case of wastefulness is worth noting in this connection, not only as an instance of wastefulness, but for the great and direct damage resulting from it. To meet the demands of a great mining company on one of the Sierra Nevada ranges a band of men, numbering thousands in all, were sent with their axes into a forest district in that vicinity. It was an extensive region and the forest presented a stand of trees not excelled, perhaps, in quality in all the country. Every condition of climate and soil had been favorable for their growth. They stood thick and stalwart.

As the quickest and easiest way of getting out the largest trees, which were the ones wanted for the miners' use, the forest was cut clean and leveled with the ground. Then, the timber having been removed, the remaining trees, spread over miles and miles of the mountain side, were given to the flames. The fire not only consumed the trees, but burned up the soil beneath them—the rich leaf mold, which was the accumulation of centuries of tree growth. The very rocks beneath it were so heated by the mighty mass of burning fuel that, in many places, they crumbled to gravel. When the rains came and the snows melted rapidly in springtime—having no sheltering foliage of the trees to protect them from the rays of the sun—the ashes of the burned trees, and what was left of the soil, together with the rocky gravel, were swept down the mountain side with torrent swiftness and force, overflowing the banks of the water courses, tearing

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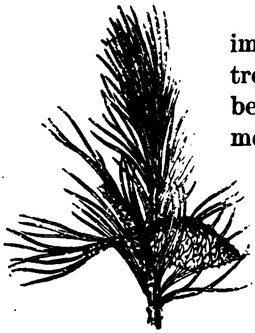

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the popular need was heartily responded to, and it was reported that many millions of trees were planted that year in Nebraska. This successful inauguration of Arbor Day led to its institution the same year by the horticultural society in Iowa, to be followed quickly by its adoption in Minnesota, Ohio, and other Western States.

A few years later Arbor Day assumed a new character and acquired a wider interest with the people as it became connected in its observance with the public schools. This it did for the first time during the sessions of a national forestry convention at Cincinnati in the year 1882. The sessions of the convention were continued through five days, on one of which there was a public parade, civic and military, with a march to Eden Park, where groves were planted and single trees in memory of distinguished men—poets, orators, governors, and others. The school children and their teachers formed a conspicuous feature of the pageant and the planting of the trees was done principally by them. Tree planting thus became a festivity, combining at once pleasure and utility. That Cincinnati observance was an object lesson for the country, as the report of it was published far and wide.

A national forestry association was formed at the time of the Cincinnati convention, and at its meeting in St. Paul the following year a resolution was adopted favoring the observance of Arbor Day by the schools of the country. A standing committee on Arbor Day was also appointed, and such a committee has been appointed at nearly every annual meeting of the association. Wherever since then Arbor Day has been adopted its observance has been connected with the schools, as it has been also in the States where it had been established before. Thus it has become a school festival, as it has also become a national one. It was only what might have been expected, therefore, that at the meeting of the National Education Association, at Saratoga, in July, 1892, when the subject had been brought to its attention by the Hon. B. G. Northrop. the committee to whom it was referred should report as follows:

> Your committee reports with pleasure that Arbor Day is now observed in accordance with legislative act, or annual public proclamation, in forty States and Territories. We recommend that the observance be universal, that village and district improvement associations be formed, that memorial trees be planted, and that appropriate means be employed to inspire in pupils and parents the love of beauty and a desire for home and landscape adornment.

Arbor Day is educational in the best and largest sense. By engaging the pupils of the schools in the study of trees, not merely from books but by actual observation and handling of them in their living state, the observing faculties of the pupils are appealed to and cultivated, and their minds are easily led on from the study of trees to that of shrubs and flowering plants and all natural objects. There can be no better training than this. It forms one of the best equipments for success in life in whatever employments one may be engaged, and is a

never-failing source of enjoyment. No studies are more wholesome than those of natural objects. They are suggestive of only what is good. They cultivate the sense and love of the beautiful everywhere. They meliorate the nature within us and fit us to be associates with one another, and to become worthy members of society wherever we may be.

And so Arbor Day and its public observance, taken with the studies connected with it, has led on naturally to the formation of town and village improvement societies and various other associations and organizations for the promotion, in one way and another, of the public welfare. The spirit of Arbor Day is benevolent. Its aim is the public good in some form, and it has a wide outlook. There is nothing narrow or selfish about it. If it plants trees, it is not for the benefit of any individual alone, but for all who may see them and have the benefit of them, whether soon or centuries hence. It plants for those who are to come, as well as for those now living.

Arbor Day is the one festival or celebration which, instead of looking backward and glorifying the heroes and achievements of the past or recounting the praises of present enterprises or actors, looks forward and seeks to make a better environment and a better inheritance for the coming generations. Its spirit is hopeful. Its motto is progress. It is ever reaching out for new acquisitions of knowledge, and seeking to impart new and more widespread benefits.

It is not a matter for wonder, therefore, that an institution with such a spirit and such possibilities, with so much to commend it to the attention of persons of intelligence and generous feeling, and especially to the ardent natures of the young, should have a speedy and wide acceptance. And so, by its own manifest merit and without any propagandism on its behalf, it has been adopted by nearly every State and Territory of the Union; and limited by no national boundaries, it has even crossed the Atlantic on the one hand, and become established in Great Britain, France, and northern and southern Africa, and during the present year in Spain, and on the other, has crossed the Pacific and been welcomed in the Hawaiian Islands and in Japan.

The beneficent results of an institution of this character, and already almost world-wide in its reach, no one can measure. Year by year it will bring millions of people, young and old, into a closer and more intimate contact with nature, unveiling to them its precious secrets, opening to them stores of valuable knowledge, and cultivating in them the best feelings. In our own country it promises to do more than anything else to convert us from a nation of wanton destroyers of our unparalleled heritage of trees to one of tree planters and protectors. Instead of looking upon the trees with indifference, or even with a hostile feeling, as to a great extent we have done, or regarding them chiefly as material for use in the constructive arts or to be consumed as fuel, we shall become tree lovers. A tree sentiment will be created and established which will lead us to recognize and cherish the trees as

friends, and while we shall freely make use of them in the various arts and industries of life, we shall be mindful of their value in other respects and find constant delight in their companionship.

To show the natural result of the establishment of Arbor Day and how it increases its hold upon the regard of a people from year to year as it becomes more and more familiar to them and its obvious lessons are learned by them, it is enough to adduce the history of Nebraska, in which the day originated—since the time it began to be celebrated there. Arbor Day originated in this manner: At an annual meeting of the Nebraska State board of agriculture held in the city of Lincoln, January 4, 1872, J. Sterling Morton, of Nebraska City, introduced the following resolution, which was unanimously adopted after some little debate as to the name, some of those present contending for the term "Sylvan" instead of "Arbor:"

Resolved, That Wednesday, the 10th day of April, 1872, be, and the same is hereby, especially set apart and consecrated for tree planting in the State of Nebraska, and the State board of agriculture hereby name it Arbor Day; and to urge upon the people of the State the vital importance of tree planting, hereby offer a special premium of one hundred dollars to the agricultural society of that county in Nebraska which shall, upon that day, plant properly the largest number of trees; and a farm library of twenty-five dollars' worth of books to that person who, on that day, shall plant properly, in Nebraska, the greatest number of trees.

The result was that over a million trees were planted in Nebraska on that first Arbor Day.

Three years later the day had attained such favor with the people that the governor, by public proclamation, set apart the third Wednesday of April as Arbor Day, and recommended that the people observe it as a day of tree planting. Annually thereafter other governors of the State followed this example, until at the session of the legislature in 1885 an act was passed designating the 22d day of April, the birthday of Mr. Morton, as the date of Arbor Day, and making it one of the legal holidays of the State.

As further showing the deep lodgment which Arbor Day has gained in the regard of the people of Nebraska, and the interest with which it is cherished by them, it is significant to notice that since the inauguration of Arbor Day a provision has been embodied in the constitution of the State which recites, "That the increased value of lands by reason of live fences, fruit, and forest trees grown and cultivated thereon shall not be taken into account in the assessment thereof."

The following statutory enactments are now in existence also:

SEC. 3. That the corporate authorities of cities and villages of the State of Nebraska shall cause shade trees to be planted along the streets thereof.

SEC. 4. For the above purpose a tax of not less than one dollar nor more than five dollars, in addition to all other taxes, shall be levied upon each lot adjacent to which the trees are to be planted as aforesaid, and collected as other taxes.

SEC. 5. Trees shall be annually planted, when practicable, on each side of one-fourth of the streets in each city and village in the State of Nebraska, until all shall have shade trees along them not more than twenty feet apart.

SEC. 6. The corporate authorities aforesaid shall provide by ordinance the distance from the side of the street that trees shall be planted, and the size thereof.

SEC. 7. *Provided*, The owner of any lot or lots may plant trees adjacent thereto where ordered as above, in the manner and of the size prescribed, and on making proof thereof by affidavit to the collector, said affidavit shall exempt said owner from the payment of the aforesaid tax.

SEC. 8. Any person who shall materially injure or shall destroy the shade tree or trees of another, or permit his animals to destroy them, shall be liable to a fine of not less than five dollars, nor more than fifty dollars for each tree thus injured or destroyed, which fine shall be collected on complaint of any person or persons before any court of proper jurisdiction. One-half of all fines thus collected shall be paid to the owner of the trees injured or destroyed; the other half shall be paid into the school fund.

SEC. 9. That this act shall not apply to any person that is occupant of any business lot without his consent.

SEC. 10. That when any person shall plant and properly cultivate for the term of five years, six rows of trees, eight feet apart, and the trees four feet apart in the row along either the north section or the half section line, running east and west, said rows to be not nearer to the said north section or half section line than four feet or to the south line of any road which may be laid out on said north section or half section line; or when any person shall fill out to the standard above prescribed, and keep the same in a proper state of cultivation for the time above stated, any rows of trees that may have previously been planted along said north section or half section line, it shall be the duty of the county commissioners to pay such person, by warrant on the county treasurer, a sum of money, amounting to three dollars and thirty-three cents per acre, for each acre so planted and cultivated annually, so long as the same is planted and kept growing and in a proper state of cultivation, for a period not to exceed the space of five years, and to an extent not to exceed three acres of land.

SEC. 11. It shall be the duty of the assessor of each precinct to make proper examination and report to the county commissioners, at the time of his annual report, the condition of all timber so planted and cultivated under the provisions of this act.

How firmly the tree-planting idea has taken hold of the people of Nebraska is further shown by a joint resolution adopted by the last legislature, and approved April 4, 1895:

Whereas the State of Nebraska has heretofore, in a popular sense, been designated by names not in harmony with its history, industry, or ambition; and

Whereas the State of Nebraska is preeminently a tree-planting State; and

Whereas numerous worthy and honorable State organizations have, by resolution, designated Nebraska as the "Tree Planter's State;" Therefore, be it

Resolved by the legislature of the State of Nebraska, That Nebraska shall hereafter, in a popular sense, be known and referred to as the "Tree Planter's State."

To this may be added, not inappropriately, another joint resolution adopted at the same session, which is an outgrowth of the same sentiment as that which led to the adoption of the popular name, "Tree Planter's State."

Whereas, the adoption of a State floral emblem by the authority of the legislature would foster a feeling of pride in our State and stimulate an interest in the history and traditions of the Commonwealth: Therefore, be it

Resolved, That, the Senate concurring, we, the legislature of Nebraska, hereby declare the flower commonly known as the "Golden Rod" (*Solidago serotina*) to be the floral emblem of the State.

Approved April 4, A. D. 1895.

The Hon. Henry R. Corbett, State superintendent of public instruction, says:

> The effect of Arbor Day it will be impossible to estimate in figures or statistics. It has resulted in stimulating a pride in the resources of Nebraska and a sentiment in favor of extending and preserving our forest areas. It is observed and talked about in every school room, and through its influence millions of trees have been planted and cared for annually throughout the State.

To these testimonies may be added the following recent statement of the Hon. R. W. Furnas, who, as governor of Nebraska, issued the first Arbor Day proclamation and who has watched with interest the progress and results of the day's observance ever since:

> No observance ever sprang into existence so rapidly, favorably, permanently, and now so near universally throughout the whole civilized world as that of "Arbor Day." It originated less than a quarter of a century since, and has been adopted, in some form or other, in all the States and Territories of this Union, and in nearly all foreign civilized countries, increasing in popularity wherever known.
>
> The words "Arbor Day" are attractive to the eye—to read in print and to meditate; they are rythmical to utter and to the ear. The word "Arbor" carries with it most pleasant remembrances to the young and promise to the older—"a bower, a seat shaded by trees." What more enticing and enchanting to refined æsthetic taste and mind than such retreat, such rest, shelter, protection? This characteristic alone makes it worthy of a permanent place in our civilization.
>
> Its economic worth, because of its usefulness among all classes of people, commends it with equal force.
>
> Its origin was prompted by a desire to ward off the rigorous winds of northwestern prairies, and to supply fuel as well. Its accomplishments in this respect are already beyond pecuniary computation. Through the instrumentality of its observance in Nebraska many thousands of acres hitherto bleak, worthless, undesirable prairie lands have been clad with millions of trees, thus converting them into valued forest groves, fruitful orchards, prosperous homes, with happy people as occupants. A great commonwealth has been built on the foundation "Arbor Day," and within the recollection of those who participated in "laying the corner stone."
>
> The influence of tree planting on the western prairies, influencing climate conditions for good, is found to be next to incalculable—retaining moisture and breaking the force of sweeping winds. Growing out of this climatic revolution is the greater result of increased crop products.
>
> Records show the number of trees planted in Nebraska since the inauguration of "Arbor Day" running into billions. Instances are also of record, where the earlier planted and more rapid growing varieties of trees which were used have been already converted into sawed lumber, of which residences and other buildings have been constructed.

It has been deemed proper to present in this extended manner an account of the inauguration, establishment, and progress of the Arbor Day institution in Nebraska as an illustration not only of what the observance of the day has effected in a particular State, but of what it is effecting in many other States and may be expected to do wherever it is established.

To show that similar results have followed the introduction of Arbor Day in other States, it will be enough to cite briefly the testimony of a few superintendents of public instruction, persons who possess the best means of information upon the subject.

Superintendent Sabin, of Iowa, well known for the great interest he has taken in the proper observance of Arbor Day, says:

Arbor Day has been regularly observed in Iowa since it was instituted in 1887. It is the custom of this department to issue an Arbor Day annual for free distribution. Special care is taken that one reaches every school in the State.

Although there is no legal requirement, the day is very generally observed by the schools, and in many cases by citizens. It is proper to say here that our school law requires every board of directors to set out and properly care for at least twelve shade trees on each school grounds not already provided with suitable shade.

The influence of such an observance is very excellent, although, as in other good work, perseverance is necessary to success. We intend to continue the custom from year to year.

The superintendent of public instruction in Wyoming says:

The day is observed by the planting of trees and appropriate exercises in each department of our schools.

A great degree of interest is manifested by the children and people generally and seems to be increasing. Pupils look forward with great pleasure to the planting and naming of their trees. In a great many schools each child contributes toward the buying of a tree, and in after years watches its growth very carefully.

Particular interest, I think, is shown in this day in Wyoming for the reason that we have so few native trees and it requires so much care to cultivate them.

E. B. Prettyman, secretary of the Maryland board of education, says:

The day is observed universally by the public schools of the State. Great int rest is manifested, which I believe to be increasing. I believe the effect of the observance of Arbor Day is very beneficial in cultivating a love for trees and for the adornment not only of school lots with trees, vines, and flowers, but that this cultivation extends to the families and homes represented in the schools.

Hon. J. M. Carlisle, superintendent of public instruction in Texas, says:

Washington's birthday, February 22, is observed in this State as Arbor Day. It is observed as a holiday, and is devoted to the planting of trees, shrubs, flowers, and the general ornamentation of public buildings and grounds. The patriotic exercises appropriate to Washington's birthday blend beautifully with the observance of Arbor Day.

The effect of the observance of the day is wholesome. Interest in the study of trees, shrubs, and flowers is stimulated, appreciation of the wonders and beauties of nature is heightened, and the sentiment in favor of both physical and moral cleanliness is greatly strengthened, while patriotic feelings are aroused and the people are drawn together by the contemplation of so many great themes in which all have a common interest.

The superintendent of public instruction in North Dakota says:

The degree of interest in the observance of the day is increasing, and the effect upon pupils of the schools and the public generally is gratifying in the same degree which marks the increasing observance of the day.

Hon. A. B. Poland, State superintendent of public instruction in New Jersey, says:

Ever since the adoption of the act for the observance of Arbor Day (1884) the observance has been universal throughout the State, and, in general, eminently satisfactory. I am of the opinion that, after eleven years' experience, the interest taken in the observance of Arbor Day has in no respect diminished. This would be a remarkable phenomenon were it not that the end subserved were generally recognized to be a useful one.

> I am of the opinion also that the participation of the schools and, to a considerable extent, the citizens in the observance of Arbor Day has resulted in a moral and æsthetic improvement that may be clearly discerned.

New York was late in adopting Arbor Day by legal provision, though the day had been more or less observed for several years; but no State, since the enactment of the "act to encourage arboriculture" (1888), has been more active or efficient in the observance of Arbor Day. Hon. Charles R. Skinner, State superintendent of public instruction, speaking of the passage of the act, says:

> Without doubt one of the effects of this legislation has been to arouse a deeper interest in trees and flowers among pupils and people. We hear more in these days concerning the preservation of our forests than before the enactment of the law. Our school grounds are kept in better condition and the trees about our schoolhouses are better protected. In thousands of cases trees so planted on Arbor Day have been named for men and women prominent in education and in our history generally.

The manuals which have been issued by the department of public instruction from year to year, and the larger and very noteworthy manual compiled by Mr. Skinner himself, testify abundantly to the vigor with which the Arbor-Day propaganda has been promoted in New York. Those manuals have been freely drawn upon in the preparation of the present publication.

The number of trees planted in New York on Arbor Day is officially stated by Mr. Skinner as follows: 1889, 24,166; 1890, 27,130; 1891, 25,786; 1892, 20,622; 1893, 15,973; 1894, 16,624.

STATES AND TERRITORIES OBSERVING ARBOR DAY.

States.	Year of first observance.	Time of observance.
Alabama	1887	22d of February.
Arizona	1890–91	First Friday after 1st of February.
Arkansas	....	
California	1886	
Colorado	1885	Third Friday in April.
Connecticut	1887	In spring, at appointment of governor.
Florida	1886	January 8.
Georgia	1887	First Friday in December.
Idaho	1886	Last Monday in April.
Illinois	1888	Date fixed by governor and superintendent of public instruction.
Indiana	1884	Date fixed by superintendent of public instruction.
Iowa	1887	Do.
Kansas	1875	Option of governor, usually in April.
Kentucky	1886	Do.
Louisiana	1888–89	Option of parish boards.
Maine	1887	Option of governor.
Maryland	1889	Option of governor, in April.
Massachusetts	1886	Last Saturday in April.
Michigan	1885	Option of governor.
Minnesota	1876	Do.
Mississippi	1892	Option of board of education.
Missouri	1886	First Friday after first Tuesday of April.
Montana	1887	Second Tuesday of May.
Nebraska	1872	22d of April.
Nevada	1887	Option of governor.
New Hampshire	1886	Do.

STATES AND TERRITORIES OBSERVING ARBOR DAY—Continued.

States.	Year of first observance.	Time of observance.
New Jersey	1884	Option of governor, in April.
New Mexico	1890	Second Friday in March.
New York	[illegible]	First Friday after May 1.
North Carolina	1893	Option of the governor, in autumn.
North Dakota	1884	[illegible] of May, by proclamation of governor.
Ohio	1882	In April, by proclamation of governor.
Oklahoma	....	
Oregon	1889	Second Friday in April.
Pennsylvania	1887	Option of governor. Alternative dates.
Rhode Island	1887	Do.
South Carolina	Uncertain.	Variable.
South Dakota	1884	Option of governor.
Tennessee	1875	November, at designation of county superintendents.
Texas	1890	22d of February.
Vermont	1885	Option of governor.
Virginia	1892	
West Virginia	1883	Fall and spring, at designation of superintendent of schools.
Wisconsin	1889	Option of governor.
Wyoming	1888	Do.
Washington	1892	Do.

Only the following three States or Territories fail to observe Arbor Day: Delaware, Indian Territory, and Utah. In Delaware the day is observed in some localities, and the same is probably true in Utah and the Indian Territory.

ARBOR DAY CELEBRATIONS.

While the object of Arbor Day, as originally instituted, was to secure the planting of trees on a large scale and for economic purposes, in a region nearly destitute of trees and where the need of them for fuel as well as for shelter was strongly felt, now that its observance has spread all over the country and has become almost universally connected with the schools, nowhere is the day welcomed with more of zest and enjoyment than in those parts of the country where trees are most abundant.

The value of Arbor Day observances in connection with our schools, therefore, is not to be measured so much by the number of trees planted at a given time as by the tree spirit implanted in those engaged in the observance, by the knowledge of tree life incidentally gained, and the feelings and principles engendered or promoted and their after influence upon life and character. The value of Arbor Day is not so much in its present enjoyments for a day as in what it does by preparing our growing youth to be useful and happy men and women when they reach the position of influence and responsibility, when the duties of public and social life and the molding and direction of social and political affairs are to be transferred from those who now control them and are to be assumed by themselves.

It is much in favor of the day and its appropriate observance that it may afford such opportunities for bringing the young so pleasantly into contact with Nature, and opening their minds in their most impressible time to her healthy and happy influences. It is good to take the pupils out of the schoolroom for a day into the open air, into Nature's school place. And it would be a good thing if they could be taken into the fields and groves, under the judicious guidance of their teachers, not only once a year, but oftener. An occasional half-holiday thus taken would be of more real benefit, more instructive, than any equal portion of time spent in the schoolroom. It would be taking the children to the original fountains of knowledge, where they would gain it at first and not at second hand. Fresh flowers are better than those of the herbarium. It would give scope and stimulus to their observing faculties, the first to open and the first which offer themselves to be trained for proper use, on whose proper use also the success and happiness of after life chiefly depend. As Wordsworth says:

> Nature never did betray
> The heart that loved her; 'tis her privilege,
> Through all the years of this our life, to lead
> From joy to joy; for she can so inform
> The mind that is within us, so impress
> With quietness and beauty, and so feed
> With lofty thoughts, that neither evil tongues,
> Rash judgments, nor the sneers of selfish men,
> Nor greetings where no kindness is, nor all
> The dreary intercourse of daily life
> Shall e'er prevail against us, or disturb
> Our cheerful faith that all which we behold
> Is full of blessing.

It had been a thousand times better for some if, instead of moiling over books in the schoolroom, they had been allowed to spend more of their younger days in the open world, the school of Nature, to be companions of the birds, listening to their songs and learning their habits, strolling along the brooks, following their windings through wood and meadow, and coming home laden with the treasures which Nature is ever ready to bestow upon the youngest child or the oldest man who has an eye to see and a heart to feel their beauty.

Happily, the methods of the schoolroom are better than they were, though there is still room for improvement. Nature studies have found some place in them. But these would be made more interesting and more effective if teacher and pupils together were oftener to get face to face with Nature herself, the great teacher.

METHODS OF OBSERVING ARBOR DAY.

The observance of Arbor Day may be as various in method as the tastes and inclinations of those engaged in it. Much will depend upon the teacher; much, also, upon the character of the school and the age and previous training of the pupils. If the teacher has a moderate share of inventiveness there will be little difficulty. The chief thing

is to have the pupils interested in what they do, and if they are taken into confidence by the teacher and invited to offer suggestions, they will often make a plan so sensible and satisfactory as almost to relieve the teacher from any burden of care in regard to it.

Of course it is presumed that the pupils are, to some extent, prepared beforehand for the celebration of Arbor Day by having it spoken of by the teacher and its objects explained, and that there has been more or less talk on the part of the teacher and readings about trees and plants and some familiarity with them and with the elements, at least, of vegetable physiology. It is supposed also that the history and character of distinguished persons in honor of whom it is proposed to plant trees will have been studied.

As the time of celebration draws nigh, therefore, let there be a conference between teacher and pupils as to the method to be adopted. First, as to the tree planting. Where is it to be—on the school ground or on some highway, or in some park? Is it to be done by the school or schools alone, or in cooperation with a larger general movement of the inhabitants of the place for the improvement of its appearance by a systematic planting of trees on the streets and elsewhere? How many trees will the school undertake to plant? What kinds of trees will they plant? The decision of the last question will depend upon where the planting is to take place and whether it is to be done by the school alone or in concert with others. If the planting is to be upon the school premises, it may be desirable to plant different trees from those which might be selected for the street or the park. If the planting is to be done in concert with others, a village improvement society for instance, then the choice of trees will properly be left to such society.

But these preliminary questions having been decided, in order that all may go smoothly on Arbor Day, and to provide against the impediments of unfavorable weather at that time, it is desirable to have a committee of the older pupils appointed to see that the designated trees are procured beforehand, and that holes are properly prepared for their reception, so that there may be no unnecessary delay at the time of planting.

These arrangements having been made, it remains to be decided with what ceremonies or exercises the tree planting shall be accompanied. The programme in this respect will be more or less elaborate according to the age of the pupils, the customs of the place, and the extent to which the Arbor Day spirit has been already developed. But let it be remembered that this is eminently the children's day, and that we all like ceremonies, on special occasions at least. And if the grown-up man needs drum and fife, epaulets and plumes and banners, and the measured march and countermarch to make his soldiering satisfactory, the children may well be invited on Arbor Day to march along the streets to the music of their own familiar songs, wearing such scarfs and badges as they choose to decorate themselves with, and carrying aloft their banners with the pride of young patriots and scholars.

It will be well for the pupils to assemble with their teachers at the schoolroom in the morning and spend a portion of the day—parents and friends being present also—in listening to addresses from any who may have been invited beforehand to speak to them. Essays may also be read by the older pupils. These may be interspersed with songs and recitations and familiar talks about trees and plants. Later in the day, in the afternoon, perhaps, the planting of the trees will take place, songs, addresses, and recitations accompanying the planting of each tree. The character of the weather will determine how much of the exercises shall take place in the open air and how much in the schoolroom or elsewhere. It is the custom in some places, and a very good custom it is, for all the schools to come together at some central place, after the planting is finished, and for the older people, who have been engaged in tree planting, to meet with them and all report what they have done, and end the day with an hour or two around a well-spread table, and with music, songs, and perhaps pleasant games.

ADDRESSES AND EXTRACTS.

The following address by Hon. J. Sterling Morton, delivered April 22, 1887, at the State University, Lincoln, Nebr., has a fitting place in a manual of Arbor Day:

ARBOR DAY: ITS ORIGIN AND GROWTH.

Ladies and Gentlemen: Just as stars in the sky brighten all the firmament with light, so holidays and anniversaries commemorate exalted characters, recall noble deeds, and perpetuate pure principles, illumine the arena of human life, and light up the higher pathways for manly effort and ambition.

Ordinary holidays are retrospective. They honor something good and great which has been, and, by its exaltation, commend it to the emulation of mankind. Thus the past is made to inspire the present, and the present to reach into and influence the immeasurable and unknowable future.

But "Arbor Day"—Nebraska's own home-invented and home-instituted anniversary—which has been already transplanted to nearly every State in the American Union, and even adopted in foreign lands, is not like other holidays. Each of those reposes upon the past, while Arbor Day proposes for the future. It contemplates, not the good and the beautiful of past generations, but it sketches, outlines, establishes the useful and the beautiful for the ages yet to come. Other anniversaries stand with their backs to the future, peering into and worshipping the past; but Arbor Day faces the future with an affectionate solicitude, regarding it as an artist his canvas, and etches upon our prairies and plains gigantic groves and towering forests of waving trees, which shall for our posterity become consummate living pictures, compared to which the gorgeous colorings of Rubens are tame and insignificant.

The wooded landscape in sunlight and in shadow, which you—in the trees you have planted to-day—have only faintly limned, shall in the future fruition of their summer beauty compel the admiration and gratitude of men and women now unborn,

who shall see with interest and satisfaction their symmetry and loveliness. As one friend hands to another a bouquet, so this anniversary sends greetings and flowers, foliage and fruit, to posterity. It is the sole holiday of the human family which looks forward and not backward.

Arbor Day originated in Lincoln on January 4, 1872. Upon that day the festival was instituted by a resolution of the Nebraska State board of agriculture. It was my good fortune to have thought out this plan for popularizing arboriculture and to have originated the term or phrase "Arbor Day" and to have written, submitted, and advocated that resolution, and thus to have established this anniversary. It will grow in popular esteem from year to year, until finally it shall be observed universally throughout the Union of American States.

It has become the scholastic festival of our times. Common schools, colleges, and universities have taken its practical observance under their own special and intelligent direction. The zeal of youth and the cultured love of the beautiful combine to perpetuate and to popularize it.

That which should survive in America must harmonize with education and refinement. Whatsoever the schools, the teachers, and the pupils shall foster and encourage, shall live and flourish, mentally and morally, forever. Students, scholars, and philosophers have ever been associated with trees and their conservation. The Academeia of Athens where Socrates and Plato taught was only a grove of plane trees. There rhetoric, logic, and philosophy were given to the youth of Greece by those majestic men, whose great thoughts more than two thousand years after their death are still vitalizing and energizing the world of mind. The plane tree that Agamemnon planted at Delphos; the one grown by Menelaus, the husband of Helen of Troy; and that one which so charmed Xerxes with its surpassless beauty, when invading Greece with his great army, that he remained one entire day wrapped in its admiration, encircling it with a gold band, decking it with precious jewels, having its figure stamped upon a golden medal, and by his delay losing his subsequent battle with the Greeks—these are all historic trees and yet strangers almost to the average reader.

But the beautiful avenues and tranquil shades of the grand plane tree, which adorned the Academeia of Athens, are familiar to every student. The voice of Socrates mingled with the music of their waving boughs and Plato mused beneath their far-extending shadows. Thus the first fruits of philosophy are borne to us with the fact that Grecian civilization was a tree-planting civilization. And the transmitted wisdom of those ages illustrates how marvelously trees and learning have always been intimately associated together.

Upon the inner bark, called "liber," of trees came the annals, the lore of all the ancient world's written life inscribed by the stylus. Not only from tree bark has the intellect of man taken the record of its early development, but even the word "library," which embraces all the conserved thoughts of all the thinking ages, comes from the inner bark of a tree. And the word "book," take either derivation you choose, comes from one in German or Saxon or Scandinavian, meaning beech wood, because in the dawn of learning all records were written on beech boards, and the leaf and the folio which make up the book came to us also from the trees.

But leaving ancient times, ceasing to trace tree ancestry from words, and reluctantly remaining silent as to many delightful delusions concerning the sacred groves of Greece and Rome and their storied genii, who gave wisdom to sages and judgment to lawmakers, and skipping likewise all the tree lore and tree metaphor in the Bible—and that is indeed self-denial on an occasion like this—let us see how forests and our English ancestry are indissolubly connected, and how, by the very law of heredity, we should all become amateur foresters.

The Druids first planted forests and groves in England. In the misty twilight between barbarism and civilization the teachers and students of Great Britain were Druids. All their discourses and ceremonies transpired in the oaken groves and

sacred orchards of their own planting, and Pliny declares the word "Druid" to have come from the Greek word *drus*—an oak. And while no Druid oaks now remain, there are still in England many very venerable trees. Among them are the Damory oak, of Dorsetshire, 2,000 years of age; Owen Glendower's oak at Shelton, near Shrewsbury, from the branches of which that chieftain looked down upon the battle between Henry IV and Henry Percy in 1403. The great oak of Magdalen College, Oxford, was a sturdy sapling when nine hundred years ago Alfred the Great founded that institution of learning. It received injuries during the reign of Charles I which at the close of the last century caused its decay and death.

Windsor Forest is notable also for its majestic oaks of great age, one of them known to have withstood more than a thousand years of winter and summer storms. Not many decades have passed since Herne's oak, which had borne that hunter's name from the reign of Elizabeth, was blown down. In the Merry Wives of Windsor, Shakespeare has told its story Elizabeth, who was first saluted at Hatfield as "the Queen of England," in the shade of the towering trees of oak which line its broadest avenues, greatly encouraged agriculture, and was among the first English-speaking advocates of forestry.

When Columbus was seeking a new world, his crew, anxious and incredulous, even unto mutiny, the waves bore out to his ship twigs and foliage from the forests of the unknown land, giving him hope, faith, victory even, as the dove with the olive branch had carried God's peace to Noah centuries before.

Nearly two hundred years after Columbus came the Puritans, and then began the war upon the woodlands of America. Since then, ax in hand, the race has advanced from the Atlantic Seaboard westward for more than two centuries, devastating forests with most unreasoning energy, always cutting them down, and never replanting them. Hewing their way through the Eastern and Middle States, the pioneers have wantonly destroyed without thought of their posterity millions upon millions of acres of primeval woodlands.

Cleaving right and left through Ohio, Michigan, and Indiana, felling giant trees, rolling them into log heaps and destroying them by fire, emigration emerged upon the treeless plains of Illinois and the Northwest.

Nature teaches by antithesis. When sick we learn to value health; when blind we realize the beneficence, the surprising and delicious sense of sight; when deaf we dream of the music we loved to hear, and melodies forever dead to the ear float through the mind that is insulated from sound like sweet memories of the loved and lost. So these treeless plains, stretching from Lake Michigan to the Rocky Mountains, were unfolded to the vision of the pioneer as a great lesson to teach him, by contrast with the grand forests whence he had just emerged, the indispensability of woodlands and their economical use. Almost rainless, only habitable by bringing forest products from other lands, these prairies, by object teaching, inculcated tree planting as a necessity and the conservation of the few fire-scarred forests along their streams as an individual and public duty. Hence out of our physical environments have grown this anniversary and the intelligent zeal of Nebraskans in establishing woodlands where they found only the monotony of plain, until to-day this State stands foremost in practical forestry among all the members of the American Union.

An arboretum is to tree culture what a university is to mental life. The skilled forester gathers in the former all varieties of trees, studies the habits and requirements of each, and stimulates growth and defines forms by all the appliances of his art. In the universities are collected human intellects of all types and all degrees of strength and quickness. Here, as among the trees, are all the inexorable and ineffaceable results of the operations of the law of heredity. Here, as in the arboretum, we are taught that though nurture may do much, nature does most.

The cottonwood can never become an oak, but it can pass the oak in the race for maturity. It can even aid the oak to become more stately in form, to grow straighter

and taller than when left to itself, without the competition of more swiftly shooting trees. A row of acorns planted between two lines of infant cottonwoods will come up and make an effort to reach sunlight, up beyond the shadows of their soft-wood competitors, which oaks never make when planted by themselves. Thus in the arboretum the less is made to act as a nurse and guardian to the more valuable timber. At Arbor Lodge some years since, in 1865, I planted a long row of black walnuts between two ranks of swiftly growing soft-wood trees—maple on one side and cottonwood on the other. During these twenty years I have watched the walnuts growing symmetrically and beautifully to great height, in their struggle to reach the light up and beyond the shade of their less valuable contemporaries and co-tenants. They are higher, better trees than they would have been without the rivalry of their neighbors—their classmates.

So mind by contact with mind and struggle of brain with brain is improved. The mediocrity of one is almost obliterated by contests with the superiority of another. Just as trees seek—must have—sunlight, just as they reach up into the sky for it out from shade, so the mind in competitive seeking after knowledge ever exalts itself, perfects and embellishes itself. A dull brain developing in solitude is dwarfed and gnarled like a lone oak on the prairie; but associated with the sharp, quick perceptions of its superiors, it becomes a better brain, and bestows benefits upon mankind where in solitude it would have withered into fruitlessness. The wonderful similitudes between tree life and human life are almost innumerable. They have been recognized in all ages, and man's metaphors for all that is beautiful, useful, desirable, and immortal have been, since written language began, largely drawn from sylvan life. The "Tree of Knowledge," the "Tree of Liberty," the "Tree of Everlasting Life" have been planted in all poesy; they have bloomed in all literature from the remotest of historic times. Books not drawing simile, metaphor, or other figure of speech from tree life have been rare indeed. But the most beautiful tree, with its sheltering arms and its many-voiced foliage singing in the breeze, dancing in the sunbeams, and motioning to its own reflections on the greensward mirror below, with all its lustrous burden of fruit or flowers shimmering in the light, has a lower life invisible to us. Deep in the dark, damp earth its rootlets are groveling for existence—seeking here and there all manner of rottenness and feeding thereon with gluttonous avidity. Up in the clouds, gilded with sunshine, resplendent with coloring, nods the stately head; but down in the darkness and dirt are its supporters.

And as trees thus lead a dual life, an upper and a lower, so does man. The intellect, the reason, bathes in the light of knowledge. It scales the height of the firmament and reads the story of the stars. It descends into the profoundest depths of the sea and wrenches the secrets of creation from the rocks and shoals. Beautiful, symmetrical, flashing, and entrancing as a grand oak in autumn when crowned with gorgeous gold and crimson and purple leaves is the sturdy mind of a mature man, who, in temperance and tranquillity, has during a useful life grown strong in knowle ge, in truth, fidelity, and honor.

Man's intellectual life must dominate. His lower life must be subservient. His mentality, like the tree top with its foliage, flowers, and luscious fruit, alone bestows the blessings. That is man's higher life, and where it governs, man is man as nature meant man to be. The small trees of to-day's planting will develop into the groves and forests of the future. They will contribute the materials for ships, railroads, business edifices, and homes, to be used by those who are born in coming centuries.

The almost infinite possibilities of a tree germ came to my mind last summer when, traveling in a railway carriage amid the beautifully cultivated fields of Belgium, a cotton wood seed on its wings of down drifted into my compartment. It came like a materialized whisper from home. Catching it in my hand I forgot the present and wandered into the past to a floating mote like that, which had years and years before been planted by the winds and currents on the banks of the Missouri. That mote had taken life and root and growing to splendid proportions until in 1854 the

The Hon. Henry R. Corbett, State superintendent of public instruction, says:

> The effect of Arbor Day it will be impossible to estimate in figures or statistics. It has resulted in stimulating a pride in the resources of Nebraska and a sentiment in favor of extending and preserving our forest areas. It is observed and talked about in every school room, and through its influence millions of trees have been planted and cared for annually throughout the State.

To these testimonies may be added the following recent statement of the Hon. R. W. Furnas, who, as governor of Nebraska, issued the first Arbor Day proclamation and who has watched with interest the progress and results of the day's observance ever since:

> No observance ever sprang into existence so rapidly, favorably, permanently, and now so near universally throughout the whole civilized world as that of "Arbor Day." It originated less than a quarter of a century since, and has been adopted, in some form or other, in all the States and Territories of this Union, and in nearly all foreign civilized countries, increasing in popularity wherever known.
>
> The words "Arbor Day" are attractive to the eye—to read in print and to meditate; they are rythmical to utter and to the ear. The word "Arbor" carries with it most pleasant remembrances to the young and promise to the older—"a bower, a seat shaded by trees." What more enticing and enchanting to refined æsthetic taste and mind than such retreat, such rest, shelter, protection? This characteristic alone makes it worthy of a permanent place in our civilization.
>
> Its economic worth, because of its usefulness among all classes of people, commends it with equal force.
>
> Its origin was prompted by a desire to ward off the rigorous winds of northwestern prairies, and to supply fuel as well. Its accomplishments in this respect are already beyond pecuniary computation. Through the instrumentality of its observance in Nebraska many thousands of acres hitherto bleak, worthless, undesirable prairie lands have been clad with millions of trees, thus converting them into valued forest groves, fruitful orchards, prosperous homes, with happy people as occupants. A great commonwealth has been built on the foundation "Arbor Day," and within the recollection of those who participated in "laying the corner stone."
>
> The influence of tree planting on the western prairies, influencing climate conditions for good, is found to be next to incalculable—retaining moisture and breaking the force of sweeping winds. Growing out of this climatic revolution is the greater result of increased crop products.
>
> Records show the number of trees planted in Nebraska since the inauguration of "Arbor Day" running into billions. Instances are also of record, where the earlier planted and more rapid growing varieties of trees which were used have been already converted into sawed lumber, of which residences and other buildings have been constructed.

It has been deemed proper to present in this extended manner an account of the inauguration, establishment, and progress of the Arbor Day institution in Nebraska as an illustration not only of what the observance of the day has effected in a particular State, but of what it is effecting in many other States and may be expected to do wherever it is established.

To show that similar results have followed the introduction of Arbor Day in other States, it will be enough to cite briefly the testimony of a few superintendents of public instruction, persons who possess the best means of information upon the subject.

Superintendent Sabin, of Iowa, well known for the great interest he has taken in the proper observance of Arbor Day, says:

Arbor Day has been regularly observed in Iowa since it was instituted in 1887. It is the custom of this department to issue an Arbor Day annual for free distribution. Special care is taken that one reaches every school in the State.

Although there is no legal requirement, the day is very generally observed by the schools, and in many cases by citizens. It is proper to say here that our school law requires every board of directors to set out and properly care for at least twelve shade trees on each school grounds not already provided with suitable shade.

The influence of such an observance is very excellent, although, as in other good work, perseverance is necessary to success. We intend to continue the custom from year to year.

The superintendent of public instruction in Wyoming says:

The day is observed by the planting of trees and appropriate exercises in each department of our schools.

A great degree of interest is manifested by the children and people generally and seems to be increasing. Pupils look forward with great pleasure to the planting and naming of their trees. In a great many schools each child contributes toward the buying of a tree, and in after years watches its growth very carefully.

Particular interest, I think, is shown in this day in Wyoming for the reason that we have so few native trees and it requires so much care to cultivate them.

E. B. Prettyman, secretary of the Maryland board of education, says:

The day is observed universally by the public schools of the State. Great interest is manifested, which I believe to be increasing. I believe the effect of the observance of Arbor Day is very beneficial in cultivating a love for trees and for the adornment not only of school lots with trees, vines, and flowers, but that this cultivation extends to the families and homes represented in the schools.

Hon. J. M. Carlisle, superintendent of public instruction in Texas, says:

Washington's birthday, February 22, is observed in this State as Arbor Day. It is observed as a holiday, and is devoted to the planting of trees, shrubs, flowers, and the general ornamentation of public buildings and grounds. The patriotic exercises appropriate to Washington's birthday blend beautifully with the observance of Arbor Day.

The effect of the observance of the day is wholesome. Interest in the study of trees, shrubs, and flowers is stimulated, appreciation of the wonders and beauties of nature is heightened, and the sentiment in favor of both physical and moral cleanliness is greatly strengthened, while patriotic feelings are aroused and the people are drawn together by the contemplation of so many great themes in which all have a common interest.

The superintendent of public instruction in North Dakota says:

The degree of interest in the observance of the day is increasing, and the effect upon pupils of the schools and the public generally is gratifying in the same degree which marks the increasing observance of the day.

Hon. A. B. Poland, State superintendent of public instruction in New Jersey, says:

Ever since the adoption of the act for the observance of Arbor Day (1884) the observance has been universal throughout the State, and, in general, eminently satisfactory. I am of the opinion that, after eleven years' experience, the interest taken in the observance of Arbor Day has in no respect diminished. This would be a remarkable phenomenon were it not that the end subserved were generally recognized to be a useful one.

> I am of the opinion also that the participation of the schools and, to a considerable extent, the citizens in the observance of Arbor Day has resulted in a moral and æsthetic improvement that may be clearly discerned.

New York was late in adopting Arbor Day by legal provision, though the day had been more or less observed for several years; but no State, since the enactment of the "act to encourage arboriculture" (1888), has been more active or efficient in the observance of Arbor Day. Hon. Charles R. Skinner, State superintendent of public instruction, speaking of the passage of the act, says:

> Without doubt one of the effects of this legislation has been to arouse a deeper interest in trees and flowers among pupils and people. We hear more in these days concerning the preservation of our forests than before the enactment of the law. Our school grounds are kept in better condition and the trees about our schoolhouses are better protected. In thousands of cases trees so planted on Arbor Day have been named for men and women prominent in education and in our history generally.

The manuals which have been issued by the department of public instruction from year to year, and the larger and very noteworthy manual compiled by Mr. Skinner himself, testify abundantly to the vigor with which the Arbor-Day propaganda has been promoted in New York. Those manuals have been freely drawn upon in the preparation of the present publication.

The number of trees planted in New York on Arbor Day is officially stated by Mr. Skinner as follows: 1889, 24,166; 1890, 27,130; 1891, 25,786; 1892, 20,622; 1893, 15,973; 1894, 16,624.

STATES AND TERRITORIES OBSERVING ARBOR DAY.

States.	Year of first observance.	Time of observance.
Alabama	1887	22d of February.
Arizona	1890–91	First Friday after 1st of February.
Arkansas		
California	1886	
Colorado	1885	Third Friday in April.
Connecticut	1887	In spring, at appointment of governor.
Florida	1886	January 8.
Georgia	1887	First Friday in December.
Idaho	1886	Last Monday in April.
Illinois	1888	Date fixed by governor and superintendent of public instruction.
Indiana	1884	Date fixed by superintendent of public instruction.
Iowa	1887	Do.
Kansas	1875	Option of governor, usually in April.
Kentucky	1886	Do.
Louisiana	1888–89	Option of parish boards.
Maine	1887	Option of governor.
Maryland	1889	Option of governor, in April.
Massachusetts	1886	Last Saturday in April.
Michigan	1885	Option of governor.
Minnesota	1876	Do.
Mississippi	1892	Option of board of education.
Missouri	1886	First Friday after first Tuesday of April.
Montana	1887	Second Tuesday of May.
Nebraska	1872	22d of April.
Nevada	1887	Option of governor.
New Hampshire	1886	Do.

STATES AND TERRITORIES OBSERVING ARBOR DAY—Continued.

States.	Year of first observance.	Time of observance.
New Jersey	1884	Option of governor, in April.
New Mexico	1890	Second Friday in March.
New York	[illegible]	First Friday after May 1.
North Carolina	1893	Option of the governor, in autumn.
North Dakota	1884	[illegible] of May, by proclamation of governor.
Ohio	1882	In April, by proclamation of governor.
Oklahoma		
Oregon	1889	Second Friday in April.
Pennsylvania	1887	Option of governor. Alternative dates.
Rhode Island	1887	Do.
South Carolina	Uncertain.	Variable.
South Dakota	1884	Option of governor.
Tennessee	1875	November, at designation of county superintendents.
Texas	1890	22d of February.
Vermont	1885	Option of governor.
Virginia	1892	
West Virginia	1883	Fall and spring, at designation of superintendent of schools.
Wisconsin	1889	Option of governor.
Wyoming	1888	Do.
Washington	1892	Do.

Only the following three States or Territories fail to observe Arbor Day: Delaware, Indian Territory, and Utah. In Delaware the day is observed in some localities, and the same is probably true in Utah and the Indian Territory.

ARBOR DAY CELEBRATIONS.

While the object of Arbor Day, as originally instituted, was to secure the planting of trees on a large scale and for economic purposes, in a region nearly destitute of trees and where the need of them for fuel as well as for shelter was strongly felt, now that its observance has spread all over the country and has become almost universally connected with the schools, nowhere is the day welcomed with more of zest and enjoyment than in those parts of the country where trees are most abundant.

The value of Arbor Day observances in connection with our schools, therefore, is not to be measured so much by the number of trees planted at a given time as by the tree spirit implanted in those engaged in the observance, by the knowledge of tree life incidentally gained, and the feelings and principles engendered or promoted and their after influence upon life and character. The value of Arbor Day is not so much in its present enjoyments for a day as in what it does by preparing our growing youth to be useful and happy men and women when they reach the position of influence and responsibility, when the duties of public and social life and the molding and direction of social and political affairs are to be transferred from those who now control them and are to be assumed by themselves.

It is much in favor of the day and its appropriate observance that it may afford such opportunities for bringing the young so pleasantly into contact with Nature, and opening their minds in their most impressible time to her healthy and happy influences. It is good to take the pupils out of the schoolroom for a day into the open air, into Nature's school place. And it would be a good thing if they could be taken into the fields and groves, under the judicious guidance of their teachers, not only once a year, but oftener. An occasional half-holiday thus taken would be of more real benefit, more instructive, than any equal portion of time spent in the schoolroom. It would be taking the children to the original fountains of knowledge, where they would gain it at first and not at second hand. Fresh flowers are better than those of the herbarium. It would give scope and stimulus to their observing faculties, the first to open and the first which offer themselves to be trained for proper use, on whose proper use also the success and happiness of after life chiefly depend. As Wordsworth says:

> Nature never did betray
> The heart that loved her; 'tis her privilege,
> Through all the years of this our life, to lead
> From joy to joy; for she can so inform
> The mind that is within us, so impress
> With quietness and beauty, and so feed
> With lofty thoughts, that neither evil tongues,
> Rash judgments, nor the sneers of selfish men,
> Nor greetings where no kindness is, nor all
> The dreary intercourse of daily life
> Shall e'er prevail against us, or disturb
> Our cheerful faith that all which we behold
> Is full of blessing.

It had been a thousand times better for some if, instead of moiling over books in the schoolroom, they had been allowed to spend more of their younger days in the open world, the school of Nature, to be companions of the birds, listening to their songs and learning their habits, strolling along the brooks, following their windings through wood and meadow, and coming home laden with the treasures which Nature is ever ready to bestow upon the youngest child or the oldest man who has an eye to see and a heart to feel their beauty.

Happily, the methods of the schoolroom are better than they were, though there is still room for improvement. Nature studies have found some place in them. But these would be made more interesting and more effective if teacher and pupils together were oftener to get face to face with Nature herself, the great teacher.

METHODS OF OBSERVING ARBOR DAY.

The observance of Arbor Day may be as various in method as the tastes and inclinations of those engaged in it. Much will depend upon the teacher; much, also, upon the character of the school and the age and previous training of the pupils. If the teacher has a moderate share of inventiveness there will be little difficulty. The chief thing

is to have the pupils interested in what they do, and if they are taken into confidence by the teacher and invited to offer suggestions, they will often make a plan so sensible and satisfactory as almost to relieve the teacher from any burden of care in regard to it.

Of course it is presumed that the pupils are, to some extent, prepared beforehand for the celebration of Arbor Day by having it spoken of by the teacher and its objects explained, and that there has been more or less talk on the part of the teacher and readings about trees and plants and some familiarity with them and with the elements, at least, of vegetable physiology. It is supposed also that the history and character of distinguished persons in honor of whom it is proposed to plant trees will have been studied.

As the time of celebration draws nigh, therefore, let there be a conference between teacher and pupils as to the method to be adopted. First, as to the tree planting. Where is it to be—on the school ground or on some highway, or in some park? Is it to be done by the school or schools alone, or in cooperation with a larger general movement of the inhabitants of the place for the improvement of its appearance by a systematic planting of trees on the streets and elsewhere? How many trees will the school undertake to plant? What kinds of trees will they plant? The decision of the last question will depend upon where the planting is to take place and whether it is to be done by the school alone or in concert with others. If the planting is to be upon the school premises, it may be desirable to plant different trees from those which might be selected for the street or the park. If the planting is to be done in concert with others, a village improvement society for instance, then the choice of trees will properly be left to such society.

But these preliminary questions having been decided, in order that all may go smoothly on Arbor Day, and to provide against the impediments of unfavorable weather at that time, it is desirable to have a committee of the older pupils appointed to see that the designated trees are procured beforehand, and that holes are properly prepared for their reception, so that there may be no unnecessary delay at the time of planting.

These arrangements having been made, it remains to be decided with what ceremonies or exercises the tree planting shall be accompanied. The programme in this respect will be more or less elaborate according to the age of the pupils, the customs of the place, and the extent to which the Arbor Day spirit has been already developed. But let it be remembered that this is eminently the children's day, and that we all like ceremonies, on special occasions at least. And if the grown-up man needs drum and fife, epaulets and plumes and banners, and the measured march and countermarch to make his soldiering satisfactory, the children may well be invited on Arbor Day to march along the streets to the music of their own familiar songs, wearing such scarfs and badges as they choose to decorate themselves with, and carrying aloft their banners with the pride of young patriots and scholars.

It will be well for the pupils to assemble with their teachers at the schoolroom in the morning and spend a portion of the day—parents and friends being present also—in listening to addresses from any who may have been invited beforehand to speak to them. Essays may also be read by the older pupils. These may be interspersed with songs and recitations and familiar talks about trees and plants. Later in the day, in the afternoon, perhaps, the planting of the trees will take place, songs, addresses, and recitations accompanying the planting of each tree. The character of the weather will determine how much of the exercises shall take place in the open air and how much in the schoolroom or elsewhere. It is the custom in some places, and a very good custom it is, for all the schools to come together at some central place, after the planting is finished, and for the older people, who have been engaged in tree planting, to meet with them and all report what they have done, and end the day with an hour or two around a well spread table, and with music, songs, and perhaps pleasant games.

ADDRESSES AND EXTRACTS.

The following address by Hon. J. Sterling Morton, delivered April 22, 1887, at the State University, Lincoln, Nebr., has a fitting place in a manual of Arbor Day:

ARBOR DAY: ITS ORIGIN AND GROWTH.

Ladies and Gentlemen: Just as stars in the sky brighten all the firmament with light, so holidays and anniversaries commemorate exalted characters, recall noble deeds, and perpetuate pure principles, illumine the arena of human life, and light up the higher pathways for manly effort and ambition.

Ordinary holidays are retrospective. They honor something good and great which has been, and, by its exaltation, commend it to the emulation of mankind. Thus the past is made to inspire the present, and the present to reach into and influence the immeasurable and unknowable future.

But "Arbor Day"—Nebraska's own home-invented and home-instituted anniversary—which has been already transplanted to nearly every State in the American Union, and even adopted in foreign lands, is not like other holidays. Each of those reposes upon the past, while Arbor Day proposes for the future. It contemplates, not the good and the beautiful of past generations, but it sketches, outlines, establishes the useful and the beautiful for the ages yet to come. Other anniversaries stand with their backs to the future, peering into and worshipping the past; but Arbor Day faces the future with an affectionate solicitude, regarding it as an artist his canvas, and etches upon our prairies and plains gigantic groves and towering forests of waving trees, which shall for our posterity become consummate living pictures, compared to which the gorgeous colorings of Rubens are tame and insignificant.

The wooded landscape in sunlight and in shadow, which you—in the trees you have planted to-day—have only faintly limned, shall in the future fruition of their summer beauty compel the admiration and gratitude of men and women now unborn,

who shall see with interest and satisfaction their symmetry and loveliness. As one friend hands to another a bouquet, so this anniversary sends greetings and flowers, foliage and fruit, to posterity. It is the sole holiday of the human family which looks forward and not backward.

Arbor Day originated in Lincoln on January 4, 1872. Upon that day the festival was instituted by a resolution of the Nebraska State board of agriculture. It was my good fortune to have thought out this plan for popularizing arboriculture and to have originated the term or phrase "Arbor Day" and to have written, submitted, and advocated that resolution, and thus to have established this anniversary. It will grow in popular esteem from year to year, until finally it shall be observed universally throughout the Union of American States.

It has become the scholastic festival of our times. Common schools, colleges, and universities have taken its practical observance under their own special and intelligent direction. The zeal of youth and the cultured love of the beautiful combine to perpetuate and to popularize it.

That which should survive in America must harmonize with education and refinement. Whatsoever the schools, the teachers, and the pupils shall foster and encourage, shall live and flourish, mentally and morally, forever. Students, scholars, and philosophers have ever been associated with trees and their conservation. The Academeia of Athens where Socrates and Plato taught was only a grove of plane trees. There rhetoric, logic, and philosophy were given to the youth of Greece by those majestic men, whose great thoughts more than two thousand years after their death are still vitalizing and energizing the world of mind. The plane tree that Agamemnon planted at Delphos; the one grown by Menelaus, the husband of Helen of Troy; and that one which so charmed Xerxes with its surpassless beauty, when invading Greece with his great army, that he remained one entire day wrapped in its admiration, encircling it with a gold band, decking it with precious jewels, having its figure stamped upon a golden medal, and by his delay losing his subsequent battle with the Greeks—these are all historic trees and yet strangers almost to the average reader.

But the beautiful avenues and tranquil shades of the grand plane tree, which adorned the Academeia of Athens, are familiar to every student. The voice of Socrates mingled with the music of their waving boughs and Plato mused beneath their far-extending shadows. Thus the first fruits of philosophy are borne to us with the fact that Grecian civilization was a tree-planting civilization. And the transmitted wisdom of those ages illustrates how marvelously trees and learning have always been intimately associated together.

Upon the inner bark, called "liber," of trees came the annals, the lore of all the ancient world's written life inscribed by the stylus. Not only from tree bark has the intellect of man taken the record of its early development, but even the word "library," which embraces all the conserved thoughts of all the thinking ages, comes from the inner bark of a tree. And the word "book," take either derivation you choose, comes from one in German or Saxon or Scandinavian, meaning beech wood, because in the dawn of learning all records were written on beech boards, and the leaf and the folio which make up the book came to us also from the trees.

But leaving ancient times, ceasing to trace tree ancestry from words, and reluctantly remaining silent as to many delightful delusions concerning the sacred groves of Greece and Rome and their storied genii, who gave wisdom to sages and judgment to lawmakers, and skipping likewise all the tree lore and tree metaphor in the Bible—and that is indeed self-denial on an occasion like this—let us see how forests and our English ancestry are indissolubly connected, and how, by the very law of heredity, we should all become amateur foresters.

The Druids first planted forests and groves in England. In the misty twilight between barbarism and civilization the teachers and students of Great Britain were Druids. All their discourses and ceremonies transpired in the oaken groves and

sacred orchards of their own planting, and Pliny declares the word "Druid" to have come from the Greek word *drus*—an oak. And while no Druid oaks now remain, there are still in England many very venerable trees. Among them are the Damory oak, of Dorsetshire, 2,000 years of age; Owen Glendower's oak at Shelton, near Shrewsbury, from the branches of which that chieftain looked down upon the battle between Henry IV and Henry Percy in 1403. The great oak of Magdalen College, Oxford, was a sturdy sapling when nine hundred years ago Alfred the Great founded that institution of learning. It received injuries during the reign of Charles I which at the close of the last century caused its decay and death.

Windsor Forest is notable also for its majestic oaks of great age, one of them known to have withstood more than a thousand years of winter and summer storms. Not many decades have passed since Herne's oak, which had borne that hunter's name from the reign of Elizabeth, was blown down. In the Merry Wives of Windsor, Shakespeare has told its story Elizabeth, who was first saluted at Hatfield as "the Queen of England," in the shade of the towering trees of oak which line its broadest avenues, greatly encouraged agriculture, and was among the first English-speaking advocates of forestry.

When Columbus was seeking a new world, his crew, anxious and incredulous, even unto mutiny, the waves bore out to his ship twigs and foliage from the forests of the unknown land, giving him hope, faith, victory even, as the dove with the olive branch had carried God's peace to Noah centuries before.

Nearly two hundred years after Columbus came the Puritans, and then began the war upon the woodlands of America. Since then, ax in hand, the race has advanced from the Atlantic Seaboard westward for more than two centuries, devastating forests with most unreasoning energy, always cutting them down, and never replanting them. Hewing their way through the Eastern and Middle States, the pioneers have wantonly destroyed without thought of their posterity millions upon millions of acres of primeval woodlands.

Cleaving right and left through Ohio, Michigan, and Indiana, felling giant trees, rolling them into log heaps and destroying them by fire, emigration emerged upon the treeless plains of Illinois and the Northwest.

Nature teaches by antithesis. When sick we learn to value health; when blind we realize the beneficence, the surprising and delicious sense of sight; when deaf we dream of the music we loved to hear, and melodies forever dead to the ear float through the mind that is insulated from sound like sweet memories of the loved and lost. So these treeless plains, stretching from Lake Michigan to the Rocky Mountains, were unfolded to the vision of the pioneer as a great lesson to teach him, by contrast with the grand forests whence he had just emerged, the indispensability of woodlands and their economical use. Almost rainless, only habitable by bringing forest products from other lands, these prairies, by object teaching, inculcated tree planting as a necessity and the conservation of the few fire scarred forests along their streams as an individual and public duty. Hence out of our physical environments have grown this anniversary and the intelligent zeal of Nebraskans in establishing woodlands where they found only the monotony of plain, until to-day this State stands foremost in practical forestry among all the members of the American Union.

An arboretum is to tree culture what a university is to mental life. The skilled forester gathers in the former all varieties of trees, studies the habits and requirements of each, and stimulates growth and defines forms by all the appliances of his art. In the universities are collected human intellects of all types and all degrees of strength and quickness. Here, as among the trees, are all the inexorable and ineffaceable results of the operations of the law of heredity. Here, as in the arboretum, we are taught that though nurture may do much, nature does most.

The cottonwood can never become an oak, but it can pass the oak in the race for maturity. It can even aid the oak to become more stately in form, to grow straighter

and taller than when left to itself, without the competition of more swiftly shooting trees. A row of acorns planted between two lines of infant cottonwoods will come up and make an effort to reach sunlight, up beyond the shadows of their soft-wood competitors, which oaks never make when planted by themselves. Thus in the arboretum the less is made to act as a nurse and guardian to the more valuable timber. At Arbor Lodge some years since, in 1865, I planted a long row of black walnuts between two ranks of swiftly growing soft-wood trees—maple on one side and cottonwood on the other. During these twenty years I have watched the walnuts growing symmetrically and beautifully to great height, in their struggle to reach the light up and beyond the shade of their less valuable contemporaries and co-tenants. They are higher, better trees than they would have been without the rivalry of their neighbors—their classmates.

So mind by contact with mind and struggle of brain with brain is improved. The mediocrity of one is almost obliterated by contests with the superiority of another. Just as trees seek—must have—sunlight, just as they reach up into the sky for it out from shade, so the mind in competitive seeking after knowledge ever exalts itself, perfects and embellishes itself. A dull brain developing in solitude is dwarfed and gnarled like a lone oak on the prairie; but associated with the sharp, quick perceptions of its superiors, it becomes a better brain, and bestows benefits upon mankind where in solitude it would have withered into fruitlessness. The wonderful similitudes between tree life and human life are almost innumerable. They have been recognized in all ages, and man's metaphors for all that is beautiful, useful, desirable, and immortal have been, since written language began, largely drawn from sylvan life. The "Tree of Knowledge," the "Tree of Liberty," the "Tree of Everlasting Life" have been planted in all poesy; they have bloomed in all literature from the remotest of historic times. Books not drawing simile, metaphor, or other figure of speech from tree life have been rare indeed. But the most beautiful tree, with its sheltering arms and its many-voiced foliage singing in the breeze, dancing in the sunbeams, and motioning to its own reflections on the greensward mirror below, with all its lustrous burden of fruit or flowers shimmering in the light, has a lower life invisible to us. Deep in the dark, damp earth its rootlets are groveling for existence—seeking here and there all manner of rottenness and feeding thereon with gluttonous avidity. Up in the clouds, gilded with sunshine, resplendent with coloring, nods the stately head; but down in the darkness and dirt are its supporters.

And as trees thus lead a dual life, an upper and a lower, so does man. The intellect, the reason, bathes in the light of knowledge. It scales the height of the firmament and reads the story of the stars. It descends into the profoundest depths of the sea and wrenches the secrets of creation from the rocks and shoals. Beautiful, symmetrical, flashing, and entrancing as a grand oak in autumn when crowned with gorgeous gold and crimson and purple leaves is the sturdy mind of a mature man, who, in temperance and tranquillity, has during a useful life grown strong in knowledge, in truth, fidelity, and honor.

Man's intellectual life must dominate. His lower life must be subservient. His mentality, like the tree top with its foliage, flowers, and luscious fruit, alone bestows the blessings. That is man's higher life, and where it governs, man is man as nature meant man to be. The small trees of to-day's planting will develop into the groves and forests of the future. They will contribute the materials for ships, railroads, business edifices, and homes, to be used by those who are born in coming centuries.

The almost infinite possibilities of a tree germ came to my mind last summer when, traveling in a railway carriage amid the beautifully cultivated fields of Belgium, a cotton wood seed on its wings of down drifted into my compartment. It came like a materialized whisper from home. Catching it in my hand I forgot the present and wandered into the past to a floating mote like that, which had years and years before been planted by the winds and currents on the banks of the Missouri. That mote had taken life and root and growing to splendid proportions until in 1854 the

ax of the pioneers had vanquished it, and the saw, seizing it with relentless, whirling teeth, had reduced it to lumber. From its treehood evolved a human habitation, a home—my home—wherein a mother's love had blossomed and fruited with a sweetness surpassing the loveliness of the rose and the honeysuckle. Thus from that former feathery floater in mid-air grew a home and all the endearing contentment and infinite satisfaction which that blessed Anglo-Saxon word conveys—that one word which means all that is worth living for and for which alone all good men and women are living.

Here are a few acorns to-day; to-morrow, a century hence, they are sturdy oaks, then ships, railroads, carriages, and everything useful, and parts of homes which are all—in both poetry and reality—that is lovable, beautiful, and supremely tender in the career of humanity from birth to death. The real of to-day was the ideal of yesterday; the ideal of to-day will be the real of to-morrow.

And as arboretums are developing the infant forests, nursing tremendous timbers, whence masts and spars and sills and joists shall emerge into swiftly sailing ships and massive marts of trade, which are to convey and cover the commerce of coming times, so in the schools, the colleges, and universities are growing the mental timber whence the State shall cull in the near future those pillars and supports which aid to bear up forever in America civil and religious liberty; that is, freedom to think, freedom to speak, freedom to trade, freedom to develop individualism, and to assert its consciousness of right without fear either of sectarian or partisan bigotry. Let us all, then, each in his vocation and sphere, plant wisely for the years to come, rather than dwell dejectedly upon the years gone and going—the farmer, his forest and orchard, the teacher his science and morals. Improved materially by the former, intellectually by the latter, the world will well with gratitude to both. But tree planter and teacher united in one shall be declared the best benefactor of modern times—the chief provider for posterity.

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On the 10th day of July, 1886, from the crowded, hurrying streets of London I loitered into the solemn aisles of St. Paul's Cathedral. Around on every side were the statues of England's heroes. Upon tablets of brass and marble were inscribed their eulogiums. In fierce warfare on wave and field they had exalted English courage and won renown for England's arms. Nelson and Wellington, victors by sea and land, were there, and hundreds more whose epitaphs were written in blood which, as it poured from ghastly wounds, had borne other mortals to the unknown world. Few men who won distinction in civil life are entombed at St. Paul's, but among them is the gifted architect, Sir Christopher Wren, in whose brain the concept of St. Paul's Cathedral had a mental existence before it materialized in massive marble. His epitaph is plain, brief, truthful, impressive; it is one which each honorable man in all the world may humbly strive for and become the better for the striving; it is one which every faithful disciple of horticulture, of forestry, will deserve from his friends, his family, and his country; vast orchards which he has planted and the great arms of towering elms, spreading their soothing shade like a benediction over the weary wayfarer who rests at their feet, and all the fluttering foliage whispering to the wanton winds shall tell the story of his benefaction to humanity, arborphoning that epitaph with perennial fidelity. "Si quæris monumentum, circumspice"—If you seek my monument, look around you.

Appropriately following the address of Mr. Morton, some extracts from an address of the Hon. B. G. Northrop, on Arbor Day, before the Massachusetts Horticultural Society, have place here:

OBSERVANCE OF ARBOR DAY BY SCHOOLS.

In this grand work initiated by Governor Morton [J. Sterling Morton], its application to schools was not named. The great problem then was to meet the urgent needs of vast treeless prairies. At the meeting of the American Forestry Association, held at St. Paul, Minn., in August, 1883, a resolution which I offered in favor of observing Arbor Day in schools in all our States and in the provinces of the Dominion of Canada (the association being international) was adopted, and a committee to push that work was appointed. Continued as their chairman from that day to this, I have presented the claims of Arbor Day personally or by letter to the governor or State school superintendent in all our States and Territories. My first efforts were not encouraging. By men in high positions Arbor Day was deemed an obtrusive innovation. It was no surprise to me when my paper on "Arbor Day in Schools," read at the National Educational Association (department of superintendence) at Washington, in February, 1884, called out the comment, "This subject is out of place here." Though that paper was printed by the United States Bureau of Education, it was a grateful surprise that the next meeting of the National Educational Association, held in August of the same year, at Madison, Wis., with an unprecedentedly large attendance, unanimously adopted my resolution in favor of Arbor Day in schools in all our States.

The logic of events has answered objections. Wherever it has been fairly tried, it has stood the test of experience. Now such a day is observed in forty States and Territories in accordance with legislative act, or by special recommendation of the governor or State school superintendent, or the State grange, or the State horticultural and agricultural societies, and in some States, as in Connecticut, by all these combined. It has already become the most interesting, widely observed, and useful of school holidays.

Arbor Day has fostered love of country. Now that the national flag with its forty-four stars floats over all the schoolhouses in so many States, patriotism is effectively combined with the Arbor Day addresses, recitations, and songs. Among the latter, the "Star Spangled Banner" and "America" usually find a place. Who can estimate the educating influence already exerted upon the myriads of youth who have participated in these exercises?

To the teaching of forestry in schools, it is objected that the course of study is already overcrowded—and this is true. But I have long urged that trees and tree life and culture form a fit subject for the oral lessons now common in all our best schools. When agent of the board of education of Massachusetts I sometimes took to the schools and institutes a collection of our common woods, as an object lesson, one of many aids in observation, discriminating wood by the grain. The same plan was occasionally tried in Connecticut, and with good results. To give one of many illustrations: A citizen of Norfolk, Conn., offered eighteen volumes of Appleton's Science Primers to any pupil who should gather and arrange the largest and best collection of the different kinds of wood, shrub, or vine growing in that town. Great interest was awakened, and 135 varieties were gathered by all the competitors, of which the collection of Washington Beach (who won the prize) numbered 125. What a discipline in quickness and accuracy of perception those schoolboys gained while exploring the fields, hills, and mountains of this large town, and discriminating all these varieties by the grain or bark! With no interruption of studies, there was a quickened zest and vigor for school work, and, best of all, that rare and priceless attainment, a trained eye. * * *

Those talks on trees, which Superintendent Peaslee says "were the most profitable lessons the pupils of Cincinnati ever had in a single day," occupied only the morning of Arbor Day, the afternoon being given to the practical work. Since 1883 our schools have rendered new service to the State as well as to their pupils by leading them to study the habits of trees, and appreciate their value and beauty—thus tending to make practical horticulturists and arborists. How many of these children in maturer years will learn from happy experience that trees, like grâteful children, bring rich filial returns, and compensate a thousand fold for all the care they cost. George William Curtis says, "Arbor Day will make the country visibly more beautiful year by year. Every school district will contribute to the good work. The schoolhouse will gradually become an ornament of the village and the children will be put in the way of living upon more friendly and intelligent terms with the bountiful nature which is so friendly to us."

Kindred in sentiment with the address of Secretary Morton and the remarks of Dr. Northrop are the following words of Dr. E. E. Higbee, the late distinguished State superintendent of public instruction of Pennsylvania:

ARBOR DAY FOR THE COMMONWEALTH.

Recognizing the peculiar fitness of the executive proclamation fixing an Arbor Day for the Commonwealth, it has been our effort and pleasure to make it in every way as efficient for good as possible in relation to our public schools. Here, among the children, habits of thought and feeling in regard to the benefits and uses of tree planting can be formed, which will deter them, it is hoped, from that destructive greed which has forgotten the value and beauty of green woodlands and parks, and the glory of shadowy hills and leaf-hidden streams where the trout snaps the unwary fly and the liverworts peep out from the dewy moss and wake-robins nod their heads to the answering ferns. Children need, in their innocent up-springing, to have room to get away from the garish sun and rest, as upon a mother's bosom, in the twilight silence of the growing woods. We have endeavored to keep in view, so far as possible, the educational power of such things by urging that our school grounds be supplied with shade trees and shrubs and flowers, and that the naked walls of our school buildings be trellised over with vines. Children feel most deeply the ministry of that which charms the eye.

> We are what sun and winds and water make us;
> The mountains are our sponsors, and the rills
> Fashion and win their nursling with their smiles.

Unconsciously each impression of such character sinks into the tender depths of their souls and there it remains as in reflection do the willows in the placid stream. In fact, the scenes of nature are perennial companions, growing more friendly from year to year. Those most familiar, wherever we may be, are ever entering the study of our imagination and often giving direction even to our acts. "The shepherd," as with exquisite pathos has been said by Wordsworth, "is half a shepherd on the stormy sea, and hears in piping shrouds the tones of waterfalls and inland sounds of caves and trees; and in the bosom of the deep sees mountains, sees the forms of sheep that grazed on verdant hills."

Arbor Day, repeated in our schools from year to year, will cultivate a reverent love of nature, will lead our children to value studious walks along our streams and hills and through our winding valleys and wide, windy sweeps of harvest fields and meadows, and into our bosky dells to waken courteous Echo to give them answer from her mossy couch.

There is, indeed, a power and a culturing beauty in all this which every child may experience if he will; and Arbor Day serves to enforce it upon his thought. Why should not our school children cherish a holiday which brings them into direct sympathy with the sweet companionship of man with nature? Why should they not offer their aid in giving to our school-grounds green lawns over which the wind-stirred trees may scatter gold and porphyry—where the laughing daffodils may welcome the returning swallows, and glowing clusters of chrysanthemums may soften the cold of autumn winds with thoughts of summer? Why should they not surround their school home, which they must so soon leave for the harsh toil of business life, with all that can make the memory of it a joy forever?

VALUE AND USES OF ARBOR DAY

A very just tribute to the value and uses of Arbor Day will be found in the address of Prof. George Mull, of Franklin and Marshall College, in connection with the observance of the day at the High School, Lancaster, Pa.:

Arbor Day is no longer a novelty, confined here and there to isolated districts, and attracting attention in the minds of few as a conspicuous evidence of an enlightened public sentiment in a few favored localities. A good thing is always sure to make its way, and it can not be said that this particular good thing which claims our consideration to-day was slow in making its way into the heart of public-school life throughout the length and breadth of our country. Scarcely heard of, barely thought of, a few years ago, it was possible to make the statement, at the American Forestry Congress, last December, that Arbor Day is now kept in nearly every State of the Union and in some of the Territories, and, indeed, in one State, South Carolina, a whole week is now devoted annually to tree planting. Such a rapid and widespread adoption of the custom is a sufficient indication of the merits of its claim to popular favor. It is hardly time yet to count the cost and estimate the results, but from what has already been done there can be no doubt that the practical benefits accruing to the material well-being of the country from the faithful observance of the day, will, in the near future, by the incontestable proof of what the eye may behold, establish the wisdom of those who have the honor to be numbered among the founders of this most excellent institution. With reference to this phase of the subject—the bearing it has upon the material prosperity of the country—there can be no difference of opinion. Everyone who is familiar with the statistics showing the rapid destruction of our forests will readily agree that there is urgent need that the public attention should be directed to tree planting, and there is no other medium through which this can be so effectually accomplished as through the public schools. It was wisely ordered, therefore, that the public schools should be enlisted in the work of conserving the material prosperity of the State in this important respect.

But while there can be no doubt that Arbor Day owes its institution primarily to economic considerations, and that upon this ground it met with so swift a response of popular recognition and interest, it is equally certain that the founders of the day builded better than they knew. For the broad and beneficent results flowing from this movement are not to be estimated in their sum total by the impressive array of cold figures in statistical tables—not even though they reach the enormous proportions of "605,000,000 trees planted in the single State of Nebraska, and now thriving there, where a few years ago none could be seen except along the streams; and this used to be called 'The Great American Desert,' where seventeen years ago the geographies said trees would not grow—and now the leading State of America for tree planting."

But this, though it be a matter for congratulation and rejoicing, conveys but a faint idea of the importance of the day as touching the very springs of our social life by its intimate connection with the public schools of the Commonwealth. More than this, if merely utilitarian or purely commercial considerations are to dominate our reflections upon this day, then we have no hesitation in saying that the day had better not been instituted. For in the midst of the intense activity of the present age, when all around us we see the plainly marked tracks of that myriad-shaped spirit of the times, whose tendency is ever toward the practical and material side of life, and which can see little or no good in anything that has not its immediate fruitage in palpable results to be measured by the yardstick, weighed in scales, and counted up in bank books; when, in the significant language of a thoughtful public school man, "knowledge is no longer regarded as the wings wherewith we fly to Heaven, but the claws with which we burrow into the earth in search of its glittering treasures;" when, in a word, we are confronted on all sides by forces that irresistibly impel us foward in the lines of practical pursuit with a natural leaning toward selfishness and greed; under these circumstances, surely, there would seem to be no need to give impetus to a stream that has such a strong current of its own by making a special effort to set before the children of the Commonwealth the observance of this day, as an object lesson in tree planting, upon grounds of thrift and public economy alone.

Happily there is another phase of the question which makes the celebration of Arbor Day altogether commendable. I refer to the educational value it possesses, which, indeed, is not to be estimated by the stores of useful knowledge clustering around it and finding through this channel an easy way into the mental equipment of the scholars. The wise teacher, to be sure, will not fail to utilize the occasion as one of the best means placed at his disposal for the purpose of imparting practical instruction in the department of botanical science. The significance of this feature is not to be underestimated. It is of unquestionable importance, but there is still a higher importance attaching to the celebration of the day, viz, the cultivation of a feeling for nature, by bringing us into touch and sympathy with the wondrous works of the Great Creator as revealed in the manifold forms of beauty—the endless variety of his handiwork throughout the vegetable kingdom. We are so wrapped up in our daily pursuits, so immersed in the things of flesh and sense that are of necessity involved in the unceasing struggle for existence and for a comfortable living, that the deeper spiritual forces of our being are in constant danger of being suppressed. We need something to draw us away from the hardening conditions of a life centered in self and absorbed in the purely material aspect of things. Especially do we need something to create and stimulate in the hearts of our children a genuine love for the works of nature. This can not be done by the text-book study of botany—no more than the treasures of literature can be appropriated and made a heart possession by the study of grammar. It can not be done by studying nature solely in the interest of scientific truth.

To this, one of the world's greatest students of nature, Charles Darwin, has borne conclusive testimony. Indeed, it is inexpressibly sad to hear him in his later years, when the "frontlet of olive culled far and wide" was vying with the "ivy leaf, the meed of learned brows" to grace the chaplet of his enduring fame, declare in the undertones of lamentation that he could not endure to read a line of poetry, that Shakespeare was so intolerably dull as to nauseate him, that he had almost lost his taste for pictures and music, that fine scenery failed to cause him the exquisite delight it formerly did, and that his mind seemed to have become a kind of machine for grinding general laws out of large collections of facts, resulting in the atrophy of that part of the brain on which the higher tastes depend. "The loss of these tastes," mark his words, "is a loss of happiness, and may possibly be injurious to the intellect, and more probably to the moral character, by enfeebling the emotional part of our nature."

Let us take the lesson to heart. It needs to be heeded, for, in the strenuous efforts that are now being put forth, with the best of motives, to make our education more and more practical, the importance of cultivating the æsthetic and moral faculties is only too apt to be overshadowed. It is possible to become too practical. "Ruskin speaks of men so 'practical' that they would turn the human race into vegetables, make the earth a stable, and its fruit fodder. There are vine dressers and husbandmen," he says, "who love the corn they grind and the grapes they crush better than the gardens of the angels upon the slopes of Eden; hewers of wood and drawers of water, who think that the wood they hew and the water they draw are better than the pine forests that cover the mountains like the shadow of God, and the great rivers that move like his eternity." For all such, nature speaks in no intelligible voice, Milton's grand epic has no meaning because it "proves nothing," the healthy and elevating tone of the writings of a Wood and a Jefferies touches no responsive chord, and these loving interpreters of nature have their books rated "heavy" by the trade. "We observe the face of nature so little, that the few enthusiasts who have come to know her speak to us, when they would describe her beauties, in an unknown tongue."

The planting of a tree, the tender care bestowed upon it, the eager watching for new developments in its growth, the tending of a flower bed, the training of a vine, will for many a child prove the "open sesame" into the charmed circle of those forces and factors of the natural world which purify, refine, and ennoble the heart of man. The process itself can not be indicated. It is secret, silent, past finding out. It is a growth—that subtle something, which is forever escaping the clutch of the keenest investigator, only to find easy access to the soul of him who hath eyes to see and ears to hear what is revealed of the Infinite in the finite order of creation.

> Powers there are
> That touch each other to the quick—in modes
> Which the gross world no sense hath to perceive,
> No soul to dream of.
>
> —[Wordsworth.

Though we may not analyze these mysterious powers which touch us at every point of our natural environment, quickening our impulses, warming our affections, exalting our thoughts, purifying our tastes, enlightening our whole being, we know enough of them to prize them at their full value. Nor is this beyond the range of the practical. For what is more truly, more wisely practical, than to set in operation forces and influences that will contribute to the personal happiness and comfort of the individual? What more practical, than to introduce into our homes an appreciative sense of the beautiful, the healthful, the useful in nature? It is but a step from the school to the home, and it is clearly the part of practical wisdom to make that step as fraught with beneficent results as it is possible to effect in the school.

A right feeling for nature means infinitely more than the planting of trees. By a necessary law of association, it embraces a wide range of conditions in our everyday life. It means a greater exhibition of tenderness, thoughtfulness, and gentleness in our social intercourse; it means a greater regard for orderliness, neatness, and beauty in our surroundings. A tree planted needs attention and care, which can not be bestowed without entering into the general habit of the planter; it may need a box to protect it; the shrub or bed of flowers suggests the well-kept lawn or the more modest grassplat; and these in turn point to a neat fence, a clean yard with trim walks, a painted house, and within, tidy rooms, decorated walls, pictures and books, good cheer and comfort. It will be readily admitted that these things can not be, without affecting wholesomely and only for good the moral tone of the family life, and, through it, that of the community.

PLANTING TREES A PATRIOTIC DUTY.

Not less interesting and pertinent is the address of Dr. J. T. Rothrock, State commissioner of forestry of Pennsylvania, to the public schools of Lancaster on Arbor Day of last year:

Less than three centuries ago, in the providence of God, our ancestors fell heirs to a land which was not only well watered and fertile, but well wooded. It is fair to say that on the eastern slope of the continent there was no second area equal in size to Pennsylvania which possessed resources so varied and that bid fair to last so long. So rich was our inheritance that we felt we could never come to want or see the end of our resources. American extravagance has become a byword among other nations, and Pennsylvania is in no respect behind others in the sisterhood of States.

But already practically 75 per cent of our State is destitute of real forest growth, and to meet the wants of a rapidly increasing population we are now importing lumber. Not only this, but from about an eighth of the land which we have cleared we have so exhausted the fertility that it can no longer be made remunerative in agriculture. In at least one county of our State we have the word of the president judge that the barren hillsides are being deserted by their population because they can no longer wring a living from the impoverished lands.

Thus far mankind has derived its food from the soil or the water. In the statehouse of Massachusetts there hangs a figure of a codfish, to indicate that from the sea that great Commonwealth derives a large part of its support. Our waters are practically barren, and our strength must come from the soil. I desire now to leave a question with the young people of Lancaster. It is this: If on the one hand we double our population in about thirty years, and if, on the other hand, we continue to make so much of soil poorer every year, how will those who come after us obtain a living? Bear in mind that when you render the soil incapable of producing a crop you cut off the head of the State. Thirty years and more ago our nation's life was in danger. From the hillsides of Pennsylvania more than two hundred thousand brave men poured down to save the country, that your lives might be peaceful, happy, and prosperous. I know you love the dear old flag around which so many of us rallied. I know that there is not a boy or girl before me but thinks the red, white, and blue of "Old Glory" are the very brightest and best colors that fly in the breeze of any land. Its ample folds mark the thousands of schoolhouses where you are taught to become good men and women and patriotic citizens. But you are now called upon to save the State from wasting its strength, and from becoming weak and poor, when it should be strong and rich. God never allowed a child to grow up

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to be a citizen without providing something for him or her to do for the public good. Every citizen should in some way aid in making every acre of the State as productive as it can be made. Of all things, a useless soul and a useless acre are the most useless. I call upon you young people here, who are thinking already what you will do when you grow up, to resolve that you will be patriots, and help make the land in which you live as near a paradise as you can. You will be wiser if you begin at once to do some good thing. Here is a chance. Every tree that is planted helps to save water for the uses of the people. It helps to restrain the floods which destroy life and property. It helps to keep the air in pure condition for you and your associates. It helps to moderate the climate so that crops may grow and fruits mature.

If, then, you plant a tree, you increase the wealth and strength of the Commonwealth, and at the same time you aid in husbanding its resources. Is not this a worthy work? But it is so small a thing, you may say! True, but life is made up of small things. How many really great things can anyone do? The great acts of any man's life are few. It is the multitude of small deeds which makes life important.

Nebraska was once almost a treeless area. Now it is a well-wooded State. This is almost entirely due to the Arbor Day planting which Secretary Morton started a score of years ago. His example has spread from State to State, until over almost the entire Union a day is set apart every year for the purpose of tree planting. European countries are taking up with the idea. It has spread to the isles of the ocean. If we except Christmas and Easter, there is probably no anniversary more widely celebrated than Arbor Day. Of course the date must vary with the country. In our Southern States, February 22, the birthday of Washington, is often selected as Arbor Day.

I desire especially to call attention here to a mistake too often made in connection with Arbor Day: This is the planting of foreign instead of native trees. It is now well known that no foreign species except possibly the Eastern plane tree is so long-lived as the corresponding native species. As between foreign and native trees, then, give the first place to our own species. In the country, as in smaller towns, nothing is better than our white oak, a native elm, or a sugar maple. Do not plant the silver maple. It is too weak to support its own enormous growth. It must be cut back. This opens the way for decay, and just when your tree should be in its prime it is in the stage of decay.

Reforms mature slowly. See with what infinite persecution the emancipation problem was worked out! Before our land became in deed and in truth "the land of the free," every hamlet received its baptism of blood and every citizen felt the drain upon his finances.

The great temperance reform has grown from contempt into respectability, and before you young people are in the prime of life you will see under restraint the monster of intemperance, which brings untold agony into thousands of homes. So it is with the forestry problem. We are now passing from the period of destruction to the period of restoration. Hardly a State in the Union but is concerning itself with this great reform. Pennsylvania has earned a first place as a pioneer in the movement. In my travels over the country I see on all sides the signs that a reformation is at hand. When I was a lad I never saw or heard of planting a tree in a school yard. Now, in the remotest parts of the State, I see growing in school yards the trees under whose ample branches the children of the next generation will play.

I look on the hopeful side of things. The world has constantly been, in the main, becoming better fitted for the prosperity and comfort of men. It is the natural order of evolution. It is not too late to restore our forests on land where nothing but trees will grow. It is not too late to make our roadsides, our school yards, our swamp land, and our barren ridges eloquent witnesses of God's willingness to help us beautify our living places, and perpetuate the prosperity of our Commonwealth. You may never command armies, or thrill a listening nation by your eloquence; but you may at least, each one of you, leave a thrifty, growing tree, or more than one, to show those who follow that you were unselfish enough to labor for the benefit of posterity that you may never see. You may at least exemplify the noble justice of leaving the world in as good condition for the prosperity of your children as you found it for yourselves. All this you may do by simply planting a tree, which will grow while you sleep and draw its strength and its long life and large usefulness from the sunshine and the storm, costing nothing, "harming no one, blessing everyone, and pleasing God." Will you do it?

Suppose each child in the State of Pennsylvania between the ages of 5 and 17 years plants a tree which grows to a mature size. Put these all together at 15 feet apart, and you will have a forest of 11½ square miles. That means 7,360 acres of forest—good, productive forest. Each acre of such forest can, in the growing season, give back to the air about 14,500 tons of water by evaporation or transpiration. In other words, as the result of planting one tree for each school child of to-day there might be distilled back into our air, from this eleven and more square miles of forest area each growing season, 106,720,000 tons of water.

Now I want to ask you if you know what that water does up in the sky. It destroys the frost which kills your crops. That is, each one of you here who plants a long-lived tree of a kind that may grow to large proportions, will, when it has grown to middle size, be placing away up there in the sky over seventy tons of water each year, which is to help protect and produce the grain on which your grandchildren will live. Indeed, it may be, you will find when you are done with earth that you have placed something in the sky of more importance still. You know that to "love your neighbor" is half of the Divine command. Will you plant a tree somewhere this year?

SCHOOLS OF AGRICULTURE AND HORTICULTURE.

The relation of Arbor Day to agriculture and horticulture is well set forth by Hon. Charles R. Skinner, State superintendent of schools, New York:

There is a practical as well as a sentimental side to Arbor Day. It had its inception in a commendable movement looking to the protection of our forest trees, and what may be called the making of new forests on the vast plains of the West. The sentimental feature attached to its observance has been in the development of a love for Nature and her wonderful works, and in the encouragement to delightful study of trees, plants, flowers, and birds. There is no doubt that in hundreds of thousands of the children of our country there has been awakened a deep interest in the attractive study of how plants grow, of the use and abuse of trees, and of the relations which birds and flowers bear to the problem of Nature and to human happiness. A child who learns to love trees and flowers and who derives happiness from them can never go entirely wrong. The whole subject tends to a closer study of Nature in all who have a love for growing things. This study of Nature can be turned to practical use, and be made of lasting benefit to many thousands of the world's workers, especially to those whose privilege it is to till the soil—and from the farms to feed the world. There is a lack of knowledge of the scientific principles of agriculture. This lack increases manual labor without increasing results or happiness. How to make farming pleasant and profitable, how to increase its attractions, how to keep the boys on the farm are some of the problems of our times. There are mysteries of Nature which a well-educated agriculturist can solve with profit and pleasure. Ten acres scientifically tended can be made as profitable with less labor as one hundred acres carelessly cultivated. The brain should relieve the hand. Education should abolish drudgery. There is profit as well as poetry in "a little farm well tilled."

Then let us make a place in our educational system for schools of agriculture and horticulture. Our agricultural colleges have their places in the system, but they are beyond the reach and above the heads of a great majority of the boys who are to be the farmers of the future. While our common schools are laying the foundations of an all-around education, let us give our children practical lessons which will help on the farm. We may not teach all our boys to be farmers, but we may give those who go from the schools back to the farms a knowledge which shall arouse a love and an enthusiasm for agricultural pursuits which they could never otherwise obtain. This love would do more than any other influence to keep our boys on the farms. It is the child who shows most enthusiasm in study and in play. Then let us teach our children the simple lessons in botany, chemistry, geology, and

zoology, with which they may combine the study of the habits of plants and trees, how they grow and develop; the study of birds, which are the friends and not the enemies of mankind; the study of the composition of soils, the chemistry of fertilizers, the needs of grasses and grains, and the harm of noxious weeds. Let them learn that what is taken from the ground must be paid back; that there is a reciprocal relation between the soil and the fertilizer, as between the giver and receiver. How to graft, how to plant and transplant, how to save and how to prune, how to sow and how to reap, are among the things which should be taught. Give us courses in the common schools for the boys and girls who want them, which shall teach some of the pleasant things connected with farming. Teach also that it costs no more to produce a pound of good butter or cheese than a poor one. Give us a garden by the schoolhouse where the lessons of Arbor Day can be practically illustrated, where children can plant and water, where they can see things grow, see nature develop, see life in soil and plants. France is doing much in this direction, and Canada is agitating the question. Arbor Day should give us educated farmers.

ENCOURAGING WORDS FOR ARBOR DAY.

Beneficent influence of Arbor Day.—It must be borne in mind that Arbor Day is not a holiday, but simply a particular day set apart for special instruction in all that pertains to the most useful and beautiful of the kingdoms. It would not be amiss if a day were given to each of the other kingdoms, the animal and the mineral, for the same purpose. That Arbor Day has been of incalculable value, æsthetically and ethically, is no longer doubted; and, with this generation, trees around a schoolhouse are not looked upon as a source of supply for convenient instruments to maintain discipline, as they probably were a decade or two ago. The vandalism that begins with cutting and marring the school desks and destroying school shrubbery has disappeared, which is one of the innumerable arguments in favor of its beneficent influence upon the malicious passions of the young.

The lessons learned about trees, plants, and flowers since the institution of Arbor Day has caused us to observe more closely and to love more ardently these gifts of nature. Our greatest poets and statesmen have written reverently of these treasures, and spoken with sublime veneration and patriotic fervor about those of a historic reputation. The literature associated with this kingdom excels all others in purity and devoutness, and millions of the present school generation will recall these days as the one green, glowing oasis in a long life. Henry Thoreau said: "The intellect of most men is barren. It is the movings of the soul with nature that makes the intellect fruitful, that gives birth to imagination."—John Terhune, superintendent, Bergen County, N. J.

Not merely a day for tree planting.—When this day was first appointed I felt that it was not intended for us. We did not need it. Trees were abundant on our streets and around our houses. But since we have kept it, as we have for the past two years, I have had my eyes opened to its importance. We may have trees in abundance, but there is a lesson to be taught on this day that can not be put too strongly before our children. It is a day when we should strive through general exercises, and by plain talks from the teachers, committeemen, and others who may be induced to address the children, to impress upon them a love of the beautiful. Remember that our schools are expected to elevate, to make better citizens, and not simply to cram the pupils' heads full of a certain amount of knowledge, in order that they may be able to make money a little easier when they grow up. We should teach them to do all in their power to beautify their homes; also aid them in adorning their schoolrooms. Let these two places be made most attractive and the work of the schoolroom will be wonderfully advanced.

The saloon perceives the importance of this idea; witness the magnificence of some of the city saloons. Let us counteract this by doing what we can to induce the child to make his home the most attractive place in the world.

A little ingenuity will work wonders. The home of the poor is often far pleasanter than the mansion; so it does not all depend on the amount of money expended.

The same effort should be made to make the schoolroom attractive. To the effect of this I called your attention several years ago when the ungraded school was removed from the room in the old brick schoolhouse to the pleasant quarters in the Byfield building. What had been an unruly school, and one that every child dreaded to attend, became instantly a model school and one that was very popular. This is a practical illustration that we should remember. We may say that it is all nonsense; that it makes no difference what kind of a room is used for a school. Here we see most conclusively that it does.—J. P. Reynolds.

Beneficial results of Arbor Day.—Arbor Day was observed this year in all the schools according to the programme prepared by the commissioner of public schools. At nearly all the schools a tree, or vine, or shrub was planted on or near the school grounds. The encouragement of this custom will give to each class a permanent possession in the school grounds, increase their interest in the school in time to come, and be a promoter of pleasant memories of school life.

The presence of trees on or near the school grounds will attract the birds, and these by their presence will aid the teachers in inculcating the principles and practices of the Society for the Prevention of Cruelty to Animals. In one school this year attention and interest have been concentrated upon a pair of robins which built their nest in a tree in the yard and in sight from the upper windows of the schoolhouse.—W. A. Briggs, superintendent.

Indirect value.—The indirect value of Arbor Day and the opportunity it affords for moral instruction are appreciated by the teachers, whose first thought is apt to be one of regret for any interruption of regular work.—T. O. Draper, superintendent.

A beautiful custom.—Another custom which we urge all of our schools to adopt is the careful observance of, and participation in, the exercises of Arbor Day, a custom beautiful, simple, useful.—F. B. Gifford, clerk.

Gaining attention.—The subject of Arbor Day is gaining the attention of the teachers and pupils more than formerly, and it is to be hoped it will continue. If properly carried out it will cause the schoolhouse grounds to become more attractive to the children. It does seem as if the grounds around the schoolhouses of our country, where congregate some thirteen millions of pupils, should receive as much attention as the grounds around the homes, for nothing can exert more influence in creating a love for the beautiful in the minds of the rising generation.—C. J. Greene, superintendent.

Not a mere holiday.—Trees everywhere exert a controlling moral influence. They make home pleasanter, as we know and feel in our everyday existence. When a boy leaves the home of his childhood his heart, in whatever land it beats, shall, like the "seashell far from its ocean bed, retain some faint whisper of its early dwelling place." In after years the sight of home and school grounds, beautified and improved, will afford gladness and pleasure as season follows season.—D. R. Adams, superintendent.

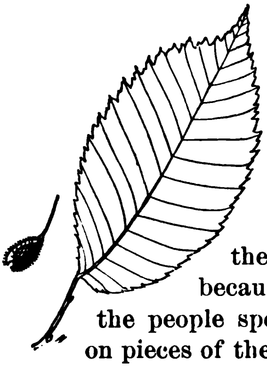
Practical use of the day.—Arbor Day and the preparation for it served to inculcate love for the whole realm of the vegetable world and much knowledge of tree and plant life. The schools also, after appropriate and interesting exercises in their respective rooms, came together at the Massasoit spring on Baker street, and planted a tree in memory of Massasoit. It might be well another year for the schools each to plant a tree on some treeless street.—A. E. Carpenter, superintendent.

Among our monumental institutions.—One of the pleasing evidences of improvement in society and the cultivation of a higher public taste is found in the establishment of Arbor Day. This interesting anniversary has not only found a place among the monumental institutions of our country, but it has met with very general and cordial approbation and support. It has its place in the calendar of our colleges, and it becomes an educational agency to all the youth of the land by its relation to our common schools. It has the support of no small number of enthusiastic advocates who promote its observance and press its claims upon the public attention, and build up around it its own peculiar and interesting literature.

As the years go by and the trees now newly planted expand themselves outward and rear themselves upward toward the sky, displaying their grand and majestic proportions, so the traditions and stories that gather round them and the day that gave them their place and their importance grow to be a living romance, blooming with elevating sentiment and bearing the fruitage of cherished associations.

When from the youth and childhood of the present proceed the names that attain to greatness and to fame, till all lands are filled with their renown, then this anniversary will bring together assemblages at the plantings of to-day to tell over with endless interest the stories of early struggles and victories, and so inspire to noble ambitions and aims the generations that are to follow.—Rev. J. Young.

TREES AND SCHOOLS.



If any persons should be peculiarly interested in trees it would seem to be those who are at school and who are especially engaged in the use of books, for the word book is the same as the old English or Anglo-Saxon word *boc*, which means a beech tree. The German *buch*, book, is almost the same as *buche*, beech; and substantially similar words are found in the Danish, Icelandic, and Gothic languages, because before the invention of printing the books of the people speaking these languages were written commonly on pieces of the bark or wood of the beech trees.

Then those who are studying Latin know that the word *liber* means both bark and book, which points to a similar usage. And those who have entered upon the study of the Greek language have learned that *biblos*, which means book, also means the inner bark of the papyrus plant, because the old Egyptians used to write upon its smooth and white surface. From the name of this plant again comes directly and easily our word paper, while to go back to *liber*, we have from that our word library, or a collection of books, and from *biblos* again our word Bible, or the book of books. And now our books are often literally made of the trees. Only instead of taking chips or blocks of the beech tree to write upon, as our ancestors did, we grind the trees up into pulp, and having spread it out into thin sheets, the printer then prints upon them lessons of geography or arithmetic or history, and lo, the beech tree and other trees also come into the school room to help us in our studies. Every time also that we turn the leaves in our books we are reminded of the trees, which have given us the word.

And then the word *academy* causes us to think of the trees, for it points us back to that celebrated school which Plato, the Greek philosopher, taught in the grove of Academus. It was a school among the trees. It was as he walked with his pupils under the branches of the trees that he taught those lessons of wisdom which have been the delight of scholars down to our own time.

Fitly, then, are the pupils in our schools invited to take part in the observance of Arbor Day, and if there is any spot peculiarly appropriate for the planting of trees on such an occasion it is that where children assemble for instruction, that thereby they may have around them the beauty and pleasantness which trees afford and every school place may become another "grove of Academe."

TREES AS LIVING THINGS.

All things in the world may be divided into two classes, things which have life and things which are without life. What life is we do not know. We know only its effects—what it does. We can neither see it nor feel it. We can not perceive it by any of our senses.

We recognize life most commonly as something which produces motion. So we say an animal is alive or has life, because we see it move. The stone is not alive; it has no motion. It does not change its shape or color. It looks to-day as it did years ago; it is no larger now than it was then. So of a piece of iron or any other metal. But the animal moves about; it changes its shape; it increases in size; it grows, as we say. From a small and very feeble thing it becomes large and strong. It is because it is a living thing or has life that it grows. The life in it has the power of laying hold of other things and building them up into the body of the animal, so that it enlarges until it has reached the size which belongs to it. So the life or life principle in us builds up our bodies little by little, and day by day, from our infancy, until we are grown-up men and women.

Now, the trees are living things like ourselves, and this gives them special interest for us. Living things have what we call organs, or instruments by means of which the life or life principle acts and performs its work. So the trees have many such organs as we have, and thereby resemble us. They have organs by which they take in food, they have lungs by which they breathe, and they have organs of digestion and a circulatory apparatus, by which their food is prepared and carried to all parts of them and causes them to grow and reach their perfection.

The trees can not move about from place to place, as we and most animals do. They would not be what they were meant to be nor of such use to us as they now are if they could. But they are none the less alive although they remain in the same place all the time. There are some animals, such as the oyster, for example, which never move about. There are also some human beings who, by accident or otherwise, have been deprived of the power to walk or to move freely, who yet are as truly alive as any. There are many plants also that have a limited power of motion which shows a close resemblance to the animals in this respect, as well as in others which have been mentioned. There are what we call the climbing plants, which climb trees or walls just as truly as boys often do. Most plants love the light and sunshine, and these climbing plants seem to climb up for the purpose of getting out of the shade of other plants and securing to themselves the needed light. So they lay hold cf any upright object near them, a stick or a tree, and winding around it or fastening their tendrils to it, climb up. Here there is motion all the time, and it can be seen very easily, especially when such a climber as the morning-glory fastens upon a short support. When it gets to the top of this it is not satisfied, but wants to go higher; so you may see it reaching out sideways and feeling around to find a new support, and it will sweep entirely around a circle, from right to left or from left to right, in order to find something to lay hold of by which it may rise still farther.

Then there are plants, like the Virginia creeper and the Japanese and English ivies, which climb walls or other objects by means of tendrils, which they stretch out like arms, and which sometimes have at their ends little disks like the suckers which boys make out of leather and with which they lift stones and other things. These disks are like so many hands, by means of which the plants climb up and hold themselves firmly where they can have the light which they need. If you try to detach one of these disks from the object to which it has fastened itself you will find it quite difficult to do so. The Venus's flytrap

(*Dionæa muscipula*) shows motion in a different way. It has at the end of its leaves an expansion like two leaves of a book ready to fold together, or like the shells of a clam. Around the margin of these leaves are bristles, with other more delicate ones in the center. When an insect alights on the open leaves and touches the central bristles, the leaves shut together so quickly that it is caught and held there till it dies. Other plants show motion in different ways. The trees also have motions independent of those which are occasioned by the wind or any external force. The locust tree and some others, for instance, fold up their leaves at night as though preparing to sleep, and spread them open again in the morning. Some move their leaves in a different manner. In all trees, also, there is in the roots a constant movement, at least during the growing season of the year. At the very beginning of its life the root as it sprouts from the seed insists upon going downward into the earth. Turn the sprouting acorn so that its root or radicle shall point upward and very soon it will turn and double upon itself, if necessary, in order to take a downward course, and though you turn it again and again, it will persist in its determination and die if necessary rather than give up the struggle. So when a tree is established and growing, though its stem must remain in the same place, its roots are all the while pushing out in various directions, winding around obstacles of one kind and another in pursuit of moisture and nourishment and making their way steadily on, so that nothing will so well describe the character of that part of the tree which is under ground as to say it is in a state of motion. Darwin, the eminent naturalist, goes so far as to claim that all the growing parts of plants, above as well as below ground, manifest voluntary motion, describing circles or circular spirals continually, "circumnutating," as he calls this movement. "If we look," he says, "for instance, at a great acacia tree, we may feel assured that every one of the innumerable growing shoots is constantly describing small ellipses, as is each petiole, subpetiole, and leaflet."[1]

The action of the life principle in the trees also often manifests astonishing force. Darwin found that the transverse growth of the radicle of a sprouting bean was able to displace a weight of 3 pounds 4 ounces in one case and one of 8 pounds 8 ounces in another. One can hardly walk where trees are growing among rocks without seeing instances of the splitting asunder of great masses of them by the growth of the tree roots which have gained entrance into their crevices when small, and in growing have expanded with irresistible force. So, also, it is a common thing to see the walls of buildings disturbed and much injured by the roots of trees growing near them. Experiments made by Professor Clark, at Amherst College, led him to think that the force exerted by a squash in growing was equal to about 5,000 pounds. Thus trees show that they are living things like us by having voluntary motion and exerting power.

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[1] Power of Movement in Plants.

Trees resemble us also as living things, and still more wonderfully, perhaps, in their choice of food. They can take food only when it is in a liquid or fluid state. They can not take any solid food, though the particles be ever so small. Nor do all trees make use of the same things for food. As they differ from one another in kind, so they require different kinds of food material in order to make them what they are. Or they require the various articles of food in different proportions one from another. They seem to have their preferences, their likes and dislikes about food, very much as we do. So, when different kinds of trees are growing together, each selects from the ground the food or the different kinds of food which will be most promotive of its growth. In this respect the trees do even better than we do, for they never take what is not good for them. The oak takes what will be best for it, and the maple what will build it up as a maple, and so of every other tree, and if the proper food does not happen to be where the tree is planted, though there may be other food in abundance, it will not become large and strong. There is hardly anything more wonderful than this instinct of trees by which they choose their food so unerringly, and the great effort which they seem to make sometimes in order to get the food they want. While they can not move from place to place, as as most animals can, because they are fixed to one spot, though some of the lower order of plants move about as freely as animals, they often send their roots long distances and over great obstacles in search of what will nourish them. Darwin, speaking of the motion of the root-tips of plants, says:

"It is hardly an exaggeration to say that the tip of the radicle, thus endowed and having the power of directing the movements of the adjoining parts, acts like the brain of one of the lower animals; the brain being seated within the anterior end of the body, receiving impressions from the sense organs, and directing the several movements."[1]

Such manifestations of life in the trees are very interesting. They are enough to make us feel that they are like us in many respects and to excite in us a sense of companionship with them, and we can hardly wonder that some people have imagined that living creatures dwelt in the trees and peopled the woods with nymphs, with dryads and hamadryads, or that in their superstition some have even worshipped trees. If we had more of that fancy of the old Greeks, that when a tree was wounded the nymph who dwelt in it was hurt or grieved, we should, perhaps, treat the trees around us with more care and have a tenderer feeling in respect to them.

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[1] Power of Movement in Plants.

TREES IN MASSES—FORESTS.

Interesting as trees are, considered singly, admirable for their beauty, every leaf a worthy object of study, we do not know their value and importance until we contemplate them in masses, or as forests. The single tree on the lawn or by the roadside may be more beautiful and excite our admiration more than any to be found in the forest, because, having abundant space and light and air on every side, it has developed itself symmetrically and to the full perfection of its nature, which the tree in the forest, more or less crowded by its neighbors, can not do. But when we come to consider the usefulness rather than the beauty of trees, we must look to the forests, those great masses which often cover whole mountains or vast plains with their continuous stretches. Let us notice, therefore, some of the uses of masses of trees, or the importance which trees have when growing together in large numbers, and which does not belong to the tree when considered singly.

In the first place, then, it is from the forest that we obtain the fuel by which principally we warm our houses and sustain the fires in most of our furnaces and factories. It is from the forest that we obtain the timber for the construction of our houses, our ships, our railway cars, and the track upon which the cars are borne so smoothly and safely. It is the forests which supply us with the raw material that is wrought into so many objects of usefulness and convenience. Professor Sargent, who undertook ten years ago to ascertain the condition of the forests of the United States, estimated the yearly value of the lumber, fuel, and other forest products at that time as more than $700,000,000. Their value is now at least $1,060,000,000, a sum that exceeds the value of our crops of wheat, oats, rye, corn, and tobacco taken together, and is greater than that of all our exports, and more than fourteen times as great as the produce of our mines of silver and gold. It is estimated that we consumed last year, of sawn lumber alone, more than 36,000,000,000 square or superficial feet. But such figures by themselves are meaningless. Let us consider, then, that this amount of lumber would load a train of cars sufficient to encircle the earth at the equator. And now, if we add to the sawn lumber, which is only a small part of the total produce of the forests, the timber, the railroad ties, the telegraph poles, the posts for fences, and the wood cut for fuel and for mining purposes, we shall have a train 100,000 miles in length, or long enough to reach four times around the globe. The weight of these forest products would be enough to load 480,000 ships of 1,000 tons each.

When we see thus what a vast amount of material of various kinds is taken from our forests every year, we have a most convincing proof of their value. We see at a glance how indispensable they are to our welfare, how many industries they must sustain, how many comforts and conveniences they must provide for all.

The importance of the forests and their usefulness to us may be shown, not only by such figures as we have just given, which indicate their total product, but in a contrasted way by considering some of what may be called the nuthought-of uses of the forest, because they are concerned with articles individually so small and insignificant.

A toothpick, for instance, is a little thing, the merest sliver of wood, yet it is reported that one factory uses 10,000 cords of wood annually in the production of these splints.

Shoe pegs are small affairs, yet a single factory sends 40,000 bushels of them to Europe yearly, besides what it disposes of at home.

A spool is of small account to us when emptied of the thread which has been wound upon it, yet there are several factories which use each from 1,800 to 3,500 cords of wood every year in making these little articles, and in one factory 150 men are said to be employed in their manufacture. Thousands of acres of birch trees have been bought at one time by some of our thread manufacturing companies, for the sole purpose of securing a supply of spools.

Who thinks much of the little friction match, as he uses it to light his lamp or his fire and then throws it away? But a single factory, it is said, makes 60,000,000 of these little things every day, using for this purpose 12,000 square feet of the best pine timber.

It will help us also to understand how much we are indebted to the forests when we find that we consume $12,000,000 worth of lumber every year for the packing-boxes alone which are required simply for the transportation of our various commodities from the producers to those who use them, and are then destroyed.

In what has been said now about the products of the forests and the benefits which they confer upon us, only a few out of many things have been mentioned. Nothing has been said of the gums and resins and spices which they afford, and which are of so much service to us. What a loss would it be to us, for instance, if we were to be deprived of india rubber and gutta-percha, or of the resin and turpentine of our pine trees, yielding us a product annually valued at $8,000,000. What could take their place? How many uses we have for them, uses many of which seem indispensable. How important to us also is the bark of many trees. We are dependent upon it for our leather. We can not put on a shoe or walk the streets without being reminded of our indebtedness to the trees. How many valuable dyestuffs, also, and how many healing medicines are obtained from the bark, as well as from the leaves and other parts of the trees. From their seeds and nuts, also, what valuable products are derived. In some countries these supply a large part of the food of the people.

But the forests are of great importance to us not only on account of what they thus yield directly for our use and comfort, but on account of their relations to climate and health, to the flow of streams, and to the great interests of agriculture, commerce, and manufactures.

By reason of the deep, spongy soil formed by the decay of their leaves through a succession of years the forests become great storehouses of moisture. The rain which falls upon them, instead of being evaporated as it is from the open ground or flowing off at once into the streams, perhaps with destructive violence, sinks into the soft and retentive soil, from which it flows out gradually into the neighboring runlets and brooks and thence into the larger streams, and preserves in them an equable flow, preventive alike of flood and droughts. It is estimated that four-fifths of the water falling on wooded areas is retained by them, whereas on those which are without timber cover only one-fifth is retained, the other four-fifths rushing off in torrents and often producing disastrous floods. Through many an under-ground channel, also, the stored-up water of the forests reappears in springs in the meadows and elsewhere, to slake the thirst of man and beast and give delight to old and young. The forests are thus our great regulators of water supply. They also protect us and protect our crops, our fruits, and our flocks from the violence of the winds. What we call a gentle wind is pleasant, but we all know that the air can move with destructive violence. We all know, also, how grateful is the shelter which a grove or even a narrow belt of trees affords from a cold wind. When the air is still it may be quite cold without occasioning us much discomfort; but when it is in motion it absorbs the heat of our bodies more rapidly by the more frequent contact of its particles with them, and this may go so far as to be very painful and, perhaps, destroy life. Now, the forests, or even a few rows of trees, greatly check the movement of the winds and thus protect us both from their chilling effect and their violence. They do the same for the crops in the farmer's fields and the fruits in his orchards. They prevent them from being withered and blasted by cold or hot winds or from being broken down by their force. People, in some of our western States especially, have found "shelter belts," as they are well called, almost indispensable to the successful cultivation of some crops.

By equalizing the temperature and moisture of the atmosphere as they do, and by other influences which they exert, the forests are also promotive of health. A region of forests, especially if it is elevated, is a healthful region. So we know what multitudes resort every year to the White Mountains of New Hampshire, and to the Adirondacks and the Catskills, or to the great forest regions of the South or of the Rocky Mountains, and how beneficial to health they find them.

In whatever aspect, then, we contemplate the forests we see that they are of the greatest value to us.

TREES IN THEIR LEAFLESS STATE.

As the season for Arbor Day and tree planting comes on, just before the buds begin to swell and are getting ready to cover the trees with a fresh mantle of leaves, it is well—as it is also when the leaves have fallen from the trees in autumn—to give attention to the bare trees and notice the characteristic forms of the various species, the manner in which their branches are developed and arranged among themselves, for a knowledge of these things will often enable one to distinguish the different kinds of trees more readily and certainly than by any other means. The foliage often serves as an obscuring veil, concealing, in part, at least, the individuality and the peculiarities of the trees. But if one is familiar with their forms of growth—their skeleton anatomy, so to speak—he will recognize common trees at once with only a partial view of them.

Some trees, as the oak, throw their limbs out from the trunk horizontally. As Dr. Holmes says: "The others shirk the work of resisting gravity, the oak defies it. It chooses the horizontal direction for its limbs so that their whole weight may tell, and then stretches them out fifty or sixty feet so that the strain may be mighty enough to be worth resisting."

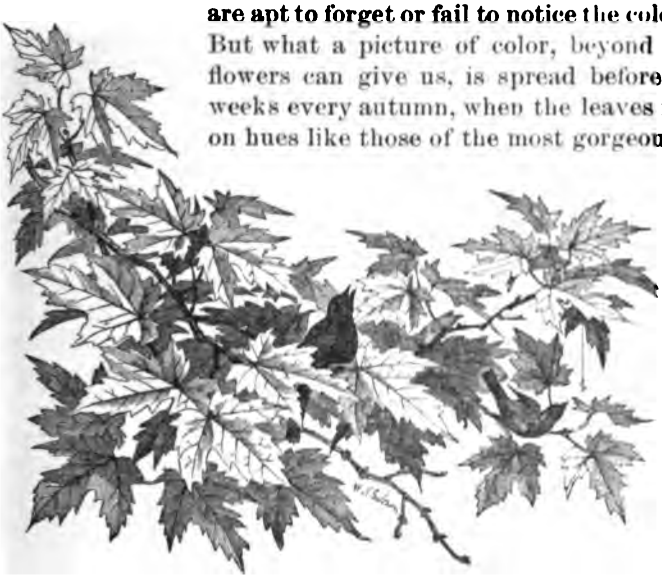
Some trees have limbs which droop toward the ground, while those of most, perhaps, have an upward tendency, and others still have an upward direction at first and later in their growth a downward inclination, as in the case of the elm, the birch, and the willows. Some, like the oak, have comparatively few but large and strong branches, while others have many and slender limbs, like some of the birches and poplars.

The teacher should call attention to these and other characteristics of tree structure, drawing the various forms of trees on the blackboard and encouraging the pupils to do the same, allowing them also to correct each other's drawings. This will greatly increase their knowledge of trees and their interest in them as well as in Arbor Day and its appropriate observance.

LEAVES, AND WHAT THEY DO.

The leaves of the trees afford an almost endless study and a constant delight. Frail, fragile things, easily crumpled and torn, they are wonderful in their delicate structure, and more wonderful if possible on account of the work which they perform.

They are among the most beautiful things offered to our sight. Some one has well said that the beauty of the world depends as much upon leaves as upon flowers. We think of the bright colors of flowers and are apt to forget or fail to notice the coloring of leaves. But what a picture of color, beyond anything that flowers can give us, is spread before our sight for weeks every autumn, when the leaves ripen and take on hues like those of the most gorgeous sunset skies, and the wide landscape is all aglow with them. A wise observer has called attention also to the fact that the various kinds of trees have in the early springtime also, only in a more subdued tone, the same colors which they put on in the autumn. If we notice the leaves carefully, we shall see that there is a great variety of color in them all through the year. While the prevailing color, or the body color, so to speak, is green, and the general tone of the trees seen in masses is green—the most pleasant of all colors to be abidingly before the sight—this is prevented from becoming dull or somber because it comprises almost innumerable tints and shades of the selfsame color, while other distinct colors are mingled with it to such an extent as to enliven the whole foliage mass. Spots of yellow, of red, of white, and of intermediate colors are dashed upon the green leaves or become the characteristic hues of entire trees, and so there is brought about an endless variety and beauty of color.



Then there is the beauty of form, size, position, and arrangement. Of the one hundred and fifty thousand or more known species of trees the leaves of each have a characteristic shape. The leaves of no two species are precisely alike in form. More than this is also true. No two leaves upon the same tree are in this respect alike. While there is a close resemblance among the leaves of a given tree, so that one familiar with trees would not be in doubt of their belonging to the same tree, though he should see them only when detached, yet there is more or less variation, some subtle difference in the notching or curving of the leaf edge perhaps, so that each leaf has a form of its own. These differences of shape in the leaves are a constant source of beauty.

What a variety of size also have the leaves, from those of the birches and willows to those of the sycamores, the catalpas, and the paulownias. On the same tree also the leaves vary in size, those nearest the ground and nearest the trunk being usually larger than those more remote. How different as to beauty would the trees be if their leaves were all of the same size; how much less pleasing to the sight.

Then, what a wide difference is there in the position of the leaves on the trees and their relative adjustment to each other! Sometimes they grow singly, sometimes in pairs, sometimes in whorls or clusters. Some droop, others spread horizontally, while others still are more or less erect. The leaves of some trees cling close to the branches, others are connected with the branches by stems of various length and so are capable of greater or less movement. The leaves of poplars and aspens have a peculiarly flattened stem, by reason of which the slightest breath of wind puts them in motion.

These are some of the most obvious characteristics of the leaves, by which also they are made the source of so much of the beauty of the world in which we live. It will be a source of much pleasure to anyone who will begin now, in the season of swelling buds and opening leaves, to watch the leaves as they unfold and notice their various forms and colors and compare them one with another. There is no better way of gaining valuable knowledge of trees than this, for the trees are known by their leaves as well as by their fruits.

But let us turn now from their outward appearance and consider what is done by them, for the leaves are among the great workers of the world, or, if we may not speak of them as workers, a most important work is done in or by means of them, a work upon which our own life depends and that of all the living tribes around us.

Every leaf is a laboratory, in which, by the help of that great magician, the sun, most wonderful changes and transformations are wrought. By the aid of the sun the crude sap which is taken up from the ground is converted by the leaves into a substance which goes to build up every part of the tree and causes it to grow larger from year to year; so that instead of the tree making the leaves, as we commonly think, the leaves really make the tree.

Leaves, like other parts of the plant or tree, are composed of cells and also of woody material. The ribs and veins of the leaves are the woody part. By their stiffness they keep the leaves spread out so that the sun can act upon them fully, and they prevent them also from being broken and destroyed by the winds as they otherwise would be. They serve also as ducts or conduits by which the crude sap is conveyed to the leaves and by which, when it has there been made into plant food, it is carried into all parts of the tree for its nourishment. Protected and upheld by these expanded woody ribs, the body of the leaf consists of a mass of pulpy cells arranged somewhat loosely, so that there are spaces between them through which air can freely pass. Over this mass of cells there is a skin, or epidermis, as it is called, the green surface of the leaf. In this there are multitudes of minute openings, or breathing pores, through which air is admitted and through which also water or watery vapor passes out into the surrounding atmosphere. In the leaf of the white lily there are as many as 60,000 of these openings in every square inch of surface and in the apple leaf not fewer than 24,000. These breathing pores, called stomates, are mostly on the under side of the leaf, except in the case of leaves which float upon the water. There is a beautiful contrivance also in connection with these pores, by which they are closed when the air around is dry and the evaporation of the water from the leaves would be so rapid as to be harmful to the tree and are opened when the surrounding atmosphere is moist.

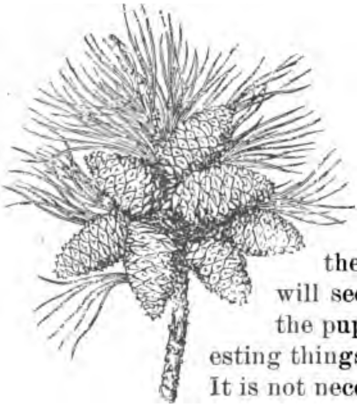
The green color of the leaves is owing to the presence in the cells of minute green grains or granules, called chlorophyll, which means leaf-green, and these granules are indispensable to the carrying on of the important work which takes place in the leaves. They are more numerous and also packed more closely together near the upper surface of the leaf than they are near the lower. It is because of this that the upper surface is of a deeper green than the lower.

Such, then, is the laboratory of the leaf, the place where certain inorganic, lifeless substances, such as water, lime, sulphur, potash, and phosphorus, are transformed and converted into living and organic vegetable matter, and from which this is sent forth to build up every part of the tree from deepest root to topmost sprig. It is in the leaves also that all the food of man and all other animals is prepared, for if any do not feed upon vegetable substances directly but upon flesh, that flesh nevertheless has been made only as vegetable food has been eaten to form it. It is, as the Bible says, "The tree of the field is man's life."

But let us consider a little further the work of the leaves. The tree is made up almost wholly of oxygen, hydrogen, and carbon. It is easy to see where the oxygen and hydrogen are obtained, for they are the two elements which compose water, and that we have seen, the roots ar absorbing from the ground all the while and sending through the body of the tree into the leaves. But where does the carbon come from? A little examination will show.

The atmosphere is composed of several gases, mainly of oxygen and nitrogen. Besides these, however, it contains a small portion of carbonic acid, that is, carbon chemically united with oxygen. The carbonic acid is of no use to us directly, and in any but very minute quantities is harmful; but the carbon in it, if it can be separated from the oxygen, is just what the tree and every plant wants. And now the work of separating the carbon from the oxygen is precisely that which is done in the wonderful laboratory of the leaf. Under the magic touch of the sun, the carbonic acid of the atmosphere, which has entered the leaf through the breathing pores or stomates and is circulating through the air-passages and cells, is decomposed, that is, taken to pieces; the oxygen is poured out into the air along with the watery vapor of the crude sap, while the carbon is combined with the elements of water and other substances which we have mentioned, to form the elaborated sap or plant material which is now ready to be carried from the leaves to all parts of the plant or tree, to nourish it and continue its growth. Such is the important and wonderful work of the leaf, the tender, delicate leaf, which we crumple so easily in our fingers. It builds up, atom by atom, the tree and the great forests which beautify the world and provide for us a thousand comforts and conveniences. Our houses and the furniture in them, our boats and ships, the cars in which we fly so swiftly, the many beautiful and useful things which are manufactured from wood of various kinds, all these, by the help of the sun, are furnished us by the tiny leaves of the trees.

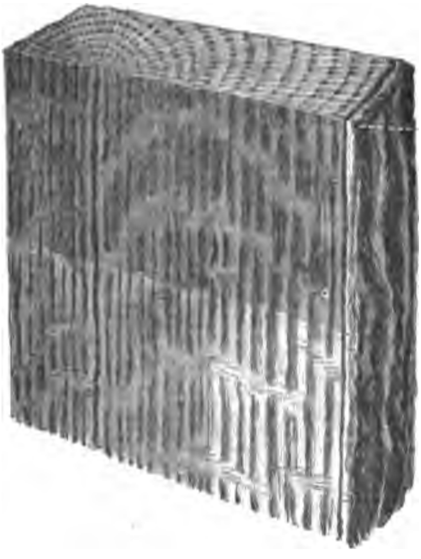
THE BEST USE OF ARBOR DAY.



Arbor Day to be most useful, as well as most pleasant, should not stand by itself, alone, but be connected with much study and talk of trees and kindred subjects beforehand and afterwards. It should rather be the focal or culminating point of the year's observation of trees and other natural objects with which they are closely connected. The wise teacher will seek to cultivate the observing faculties of the pupils by calling their attention to the interesting things with which the natural world abounds. It is not necessary to this that there should be formal classes in botany or any natural science, though we think no school should be without its botanical class or classes, nor should anyone be eligible to the place of a teacher in our public schools who is not competent to give efficient instruction in botany at least.

But much may be done in this direction informally by brief, familiar talks in the intervals between the regular recitations of the schoolroom, or during the walks to and from school. A tree by the roadside will furnish an object lesson for pleasant and profitable discourse for many days and at all seasons. A few flowers, which teacher or pupil may bring to the schoolroom, will easily be made the means of interesting the oldest and the youngest and of imparting the most profitable instruction. How easy also to plant a few seeds in a vase in the schoolroom window and to encourage the pupils to watch their sprouting and subsequent growth.

The pupils can also be readily interested in getting sections of trees so cut as to show the structure of the wood, and with a portion of the bark left upon them. It will require but a short time to accumulate quite a collection of such specimens in the schoolroom, and they will serve as a standard of reference with which to compare fresh specimens and identify them. One face of the sections should be smoothed and varnished, the others should be left as when split from the tree. The cut appended shows a good form for such sections.



Then it should not be difficult to have a portion of the school grounds set apart, where the pupils might, with the teacher's guidance, plant flower and tree seeds and thus be able to observe the ways and characteristics of plants in all periods of their growth. They could thus provide themselves with trees for planting on future Arbor Days, and at the time of planting there would be increased enjoyment from the fact that they had grown the trees for that very purpose.

Why might not every schoolhouse ground be made also an arboretum, where the pupils might have under their eyes, continually, specimens of all the trees that grow in the town or in the State where the school is situated? It would require but a little incitement from the teacher to make the pupils enthusiastic with the desire to find out the different species indigenous to the region and to gather them by sowing seeds or planting the young trees around their place of study.

And if the school premises are now too small in extent to admit of such a use, let the pupils make an earnest plea for additional ground. As a general fact our school grounds have been shamefully limited in extent, and neglected as to their use and keeping. The schoolhouse in itself and in its surroundings ought to be one of the most beautiful and attractive objects to be seen in any community. The approach from the street should be like that to any dwelling house, over well-kept walks, bordered by green turf, with trees and shrubs and flowers offering their adornment. Everything should speak of neatness and order. The playground should be ample, but it should be in a retired situation and by itself.

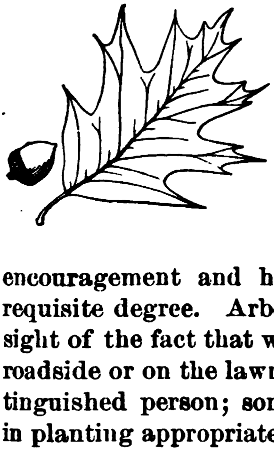
Europeans are in advance of us in school management. The Austrian public school law reads:

"In every school a gymnastic ground, a garden for the teacher, according to the circumstances of the community, and a place for the purposes of agricultural experiment, are to be created."

There are now nearly 8,000 school gardens in Austria, not including Hungary. In France, also, gardening is taught in the primary and elementary schools. There are nearly 30,000 of these schools, each of which has a garden attached to it, and the minister of public instruction has resolved to increase the number of school gardens, and that no one shall be appointed master of an elementary school unless he can prove himself capable of giving practical instruction in the culture of mother earth. In Sweden, in 1894, there were 80,000 children in the public schools receiving instruction in horticulture and tree planting. Each of more than 4,500 schools had for cultivation from one to two acres of ground.

Why should we be behind the Old World in caring for the schools? By the munificence of one of her citizens New York has twice offered premiums for the best-kept school grounds. Why may we not have Arbor Day premiums in all of our States and in every town for the most tasteful arrangement of schoolhouse and grounds? These places of education should be the pride of every community instead of being, as they so often are, a reproach and shame.

TREE PLANTING.



In considering tree planting in connection with Arbor Day, the first question to arise is, Where shall we plant? It is obvious that the practical work of Arbor Day can not include forest planting. That is a work so large and special in its nature as to require the combined effort of persons in an organized capacity, such as a town, county, or State, which shall either do the work outright or give such encouragement and help as will stimulate individual effort to the requisite degree. Arbor Day observances, to be sure, should not lose sight of the fact that we need something besides planting trees by the roadside or on the lawn, or here and there one in memory of some distinguished person; something more than the landscape gardener's art in planting appropriately public parks.[1]

These works of minor importance should lead to such a knowledge of the uses of trees in masses—the extensive forests—in connection with climate, with the flow of streams and consequently with agricultural operations and with manufactures, in short, with the general interests of household and business life, that in due time there will be developed a sentiment that will be powerful to arrest the wasteful and unnecessary destruction of our forests and insure the planting of them in places from which they have been removed or where they are specially needed. One thing is to be remembered and it is calculated to lend effectiveness to the work of Arbor Day. It is that trees are living and self-propagating things; that it is their nature to grow, and that they will grow and extend themselves on every hand if not interfered with and thwarted by man. As an illustration of this we see the abandoned farms on our hillsides soon filling up with a wood growth. It may not be of the most valuable or desirable character, but it shows what nature is ready to do, and it indicates a direction in which the influence of Arbor Day may be made effective.

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[1] The Department of Agriculture has treated the subject of forest planting in Bulletin No. 5, "Forestry for Farmers," recently published.

Let it be understood that the hills and mountain slopes are worth more for the growth of trees than for agricultural use, or rather that the tree crop is the most appropriate agricultural crop for the hill and mountain slopes, the rocky surfaces which resist the plow and the hoe. Let the farmer learn that if he will but exclude from his woodlands the browsing cattle, which are ready to eat off every tender tree as it sprouts from the ground and to break down with their heavy bulk those which have already attained a hopeful size, and if he will cull the inferior trees instead of the best, for his occasional uses, and fill the too wide vacant spaces with a judicious planting, he may soon have a woodland, though it may not have the dimensions of a forest, which will be of manifold benefit to him as well as to others and be increasing in value from year to year. This use of elevated and rocky lands, where ordinary agriculture is difficult and comparatively unremunerative, ought to be encouraged by the Arbor Day movement. It may and should make itself felt in this direction.

The same is true in reference to many sandy and swampy lands. These will nourish trees and prove a perpetual source of income. Trees, unlike the ordinary farm crops, continually improve the quality of the ground on which they grow. The German Government, in its wise and careful management, is constantly buying up the worn-out or impoverished farms of its husbandmen and by stocking them with trees restoring their fertility and fitting them again for agricultural use. On a great many of our light, sandy soils, now left as wind-swept barren fields or yielding only the most meager crops, a growth of that most valuable tree the white pine (*Pinus strobus*), may be secured in twenty years and even less, of marketable size. There is a great demand for the wood of this tree in its early stages, for the manufacture of staves, for tubs and small casks, as well as for other uses, and many landowners are finding it quite profitable to raise and market this pine at a comparatively early age.

This is not the place to discuss further the subject of forest planting or forest preservation, unless it be to say that perhaps a greater enemy of the forest than the ax is fire, and that wherever there is regard enough for trees to occasion the observance of Arbor Day there ought to be also consideration enough for the preservation of the forests of the vicinity to inaugurate some well-arranged and efficient plan to protect them from the flames which, kindled by accident or carelessness, are not only a detriment to the legal owner of the forest but to the whole community, for, in an important sense, the forests are common property. By their beauty, their influence upon climate and water supply, they are of benefit to all who live in sight of them and may be to those more distant from them. All, therefore, ought to be ready to make their preservation a common cause.

STREET PLANTING.

Forests apart, if the question arises where to plant, nearly all will say plant along the borders of the streets. This is natural and right, and so the first thing which the village improvement societies, which have sprung up so abundantly of late, have done has been to plant trees on the roadsides. Unfortunately, also, this has too often been the last thing. Village improvement has frequently exhausted itself by the wayside. This speaks well for the general estimate of trees, however it may speak for the people's estimate of what constitute the needs or the possibilities of village life.

Lane at Darlington, Md.

Certainly no one thing adds so much to the appearance of town or village, or affords so much outward comfort to its people, as to have its streets properly planted with trees. As a source of embellishment nothing can surpass it. How much would it detract from the charm of Washington, celebrated for beauty on account of its broad streets, ample parks, and the plan on which they are constructed, if its 80,000 or more trees which border those streets and adorn those parks were removed? Washington would be distinctly another city than it now is. But what is true of the National Capital is true of the smaller town or village. The difference is not in kind, but only in scale or dimension.

In deciding, however, what trees are most desirable for street or roadside planting, no little difficulty arises. No general list can be made for such an extensive country as ours. Trees which will grow well and are all that can be desired in one portion of it are not suitable for another. Trees which are at home on the Pacific Coast will pine away and die on the Atlantic. Even in localities separated by only a few miles the same kinds of trees may not flourish. Differences of soil and climate, or a particular exposure, determine to a great extent what trees are to be chosen if we would be successful in our planting. In cities, the prevalence of smoke in the atmosphere, or the escape of illuminating or other gases, complicate the problem and make the selection additionally difficult.

The American Forestry Association appointed a committee several years ago for the purpose of making a list of trees most desirable for street planting, but the committee has not yet reported. To make a list large enough for the whole country would be to include so many trees that it would be of little use for any particular locality, and to make one for a given place would be of little use to the country at large. Each locality must have its selection of trees made with reference to its particular circumstances. Happily, we have an unusually large variety of trees, excelling by far that of any other country, which admits a choice of valuable kinds adapted to every situation. Trees can, indeed, be acclimated, as people can, and when removed from their native places to other and different ones can be made to adapt themselves to their new environment. Their growth, however, is apt to be more or less feeble

Street tree planting.

and unsatisfactory. Trees have their natural homes, in which they attain their best development. The geologist, as he may be traveling swiftly over the country, can ascertain the character of the soil, its mineral composition, from the prevailing kinds of trees which from time to time meet his sight.

Some trees are less particular than others in their choice of climatic or soil conditions, and therefore are available for planting over a wider range of territory and under a greater variety of exposure. They will have their places, consequently, in many lists of desirable trees.

The Tree Planting and Fountain Society of Brooklyn, N. Y., a few years ago sent a request to various nurserymen, landscape architects, practical arboriculturists, and private citizens in different parts of the country for a small list of what they deemed the most suitable trees to be recommended for planting on the streets of Brooklyn, a general description of the character of the soil of the city having been sent with the request. Three classes of trees were asked for—large, medium sized, and smaller, for wide streets, narrow ones, and those of intermediate width. The lists received were interesting as showing the varying estimates of the same tree by different persons and also the substantial agreement of the same persons in regard to a large number of trees.

Fifteen lists were sent in, and in all about sixty trees were recommended. Of these the Norway maple was most frequently found on the lists, followed in the order of preference by the sugar maple, oriental plane, laurel-leaved willow, silver maple, European linden, American elm, sweet gum, catalpa, yellowwood, pin oak, white oak, American linden, or basswood, hackberry, scotch elm, kœlreuteria, and tulip poplar. The other trees on the lists were named only in one or two instances each.

In another list, sent from the Division of Forestry of the Department of Agriculture, and in which the rating of the trees was made up from a consideration of eight separate points, viz, endurance, or ability to withstand more or less unfavorable conditions, recuperative power, or ability to heal wounds and outgrow other injuries, cleanliness, beauty of form, abundance of shade, extent of the season when in leaf, rapidity of growth, and length of life period, the trees stood rated in the three classes thus:

LARGE-SIZED TREES.

Red oak (*Quercus rubra*), 22.
Scarlet oak (*Quercus coccinea*), 22.
Yellow oak (*Quercus tinctoria*), 22.
American elm (*Ulmus americana*), 22.
Sugar maple (*Acer saccharinum*), 19.
Black maple (*Acer nigrum*), 19.
Tulip tree (*Liriodendron tulipifera*), 19.
European linden (*Tilia vulgaris*), 19.
Sweet gum (*Liquidambar styraciflua*), 19.
White oak (*Quercus alba*), 19.
Burr oak (*Quercus macrocarpa*), 19.
Oriental plane tree (*Platanus orientalis*), 19.
Kentucky coffee tree (*Gymnocladus canadensis*), 19.
American plane tree (*Platanus occidentalis*), 18.
Sycamore maple (*Acer pseudoplatanus*), 19.
American linden (*Tilia americana*), 17.

MEDIUM-SIZED TREES.

Red maple (*Acer rubrum*), 22.
Shingle oak (*Quercus imbricaria*), 21.
Willow oak (*Quercus phellos*), 21.
Slippery elm (*Ulmus fulva*), 21.
Norway maple (*Acer platanoides*), 20.
Box elder (*Negundo aceroides*), 20.
European elm (*Ulmus campestris*), 19.
Scotch elm (*Ulmus montana*), 19.
Hackberry (*Celtis occidentalis*), 19.
Silver-leaved maple (*Acer dasycarpum*), 17.
Tree of Heaven (*Ailanthus glandulosus*), 16.
Horse chestnut (*Æsculus hippocastanum*), 16.
Japanese sophora (*Sophora japonica*), 16.
Hardy catalpa (*Catalpa speciosa*), 16.
Ginkgo or maiden hair tree (*Ginkgo biloba*), 16.
Honey locust (*Gleditsia triacanthos*), 15.
Cottonwood (*Populus monilifera*), 15.
Balm of Gilead (*Populus balsamifera var. candicans*), 15.
Black locust (*Robinia pseudacacia*), 14.

SMALL-SIZED TREES.

English maple (*Acer campestre*), 21.
Round-top locust (*Robinia pseudacacia-form*), 18.
Red horse-chestnut (*Æsculus rubicunda*), 17.
Laurel-leaved willow (*Salix pentandra*), 17.
Bay willow (*Salix laurifolia*), 17.
Green ash (*Fraxinus viridis*), 16.
European mountain ash (*Sorbus aucuparia*), 15.
American mountain ash (*Pyrus americana*), 15.
Yellowwood (*Cladastris tinctoria*), 15.

The rating of trees in this list does not differ essentially from the average rating of the lists already referred to. Such lists can not be taken as authoritative or decisive, but only as helps. Persons of equally good judgment will differ in their estimate of particular trees, and time and trial will be needed in order to reach a final decision as to the trees best adapted for use in any given place.

It hardly needs to be said that it is only on broad streets or where buildings are set well back from the street that such widespreading trees as some of the oaks are desirable for planting; but the oaks are among our best trees where there is room for them, and they should be planted on our streets much more than they have been. For ordinary streets, and especially for those which are narrow, such trees should be chosen as do not grow to large size or such as are spiry topped. Of the latter a new comer among us may be favorably mentioned, the ginkgo. This is one of the few trees which it seems desirable to cultivate in addition to the large number of valuable native trees which we have. But the peculiarity of its form and of its leaves, which mark a blending of the broad-leafed and the needle-shaped leaves, and its wonderful golden coloring in autumn, make it very attractive, and it is well adapted for planting on narrow streets as well as singly in open, lawn-like spaces. Whoever has seen the avenue leading up to the main building of the Department of Agriculture, which is bordered with the ginkgo, must feel that it is one of the most desirable trees for similar use. What degree of cold this tree will endure remains to be seen, but it is growing well as far north as Boston.

A good word should be said also for the ailanthus. It was formerly a favorite tree, but has been discarded on account of its unpleasant odor in its flowering season. This, however, may be avoided by planting only the pistillate trees, as the odor is noticeable from the staminate trees only. Professor Sargent speaks of the ailanthus as "probably the best street tree that has ever been used in northern cities."

PLANTING ON SCHOOL GROUNDS.

Where Arbor Day is observed by the schools it will, perhaps, seem that tree planting on the school grounds deserves consideration before planting on the street borders; but the two are nearly related. If an attempt is made to plant around the schoolhouse, some street planting will almost necessarily be done in connection with it. Certainly the pupils of any school should be encouraged to plant trees about the building to which they come day after day and where so much of their time is spent. They should be encouraged to make it beautiful and attractive now with foliage and flowers, and a place to which they may look back in after life with pleasant memories.

Even the smallest school ground is large enough to admit some embellishment of tree or shrub, and even a single tree will add attractiveness to the place. Such a tree planted by the children themselves will be regarded as their common property. All will be interested in it and will combine to protect it and give it all needed care. In so doing they will learn manifold lessons in regard to tree growth and habits, in regard also to the ways of the birds and insects which will frequent it. While they are cultivating the tree they may also be cultivating in themselves the best traits of character and gaining as much as from their books. But it is to be hoped that most of our school grounds are ample enough to admit of a considerable number of trees and shrubs and flowery plants besides. Then there will be opportunity for planting a variety of trees and for a careful study in order to select the best, both for beauty and for adaptation to the place where they are to stand and grow. Care should be taken that the planting of the school grounds shall not be done hastily or without due consideration, nor that too much be done in a single season. Leave some work to be done in coming years to give new zest to the Arbor Day exercises. One tree well chosen and well planted is worth a dozen or a score selected and planted as trees often are.

With many persons a tree is a tree, and peculiarities of nature or habit of growth are taken little account of. It is enough also with many, in planting, if a hole is made in the ground and the roots of the tree, many or few, are thrust into it and hastily covered with earth again. One of the most difficult things to do is to get a tree properly planted, and yet tree planting is a very simple thing. It consists in taking a tree out of the ground without injury and placing it in the ground again in another place also without injury, and with a corresponding connection with the soil such as it had before. This simply requires time, patience, and care. Yet in planting a single tree a boy may learn a lesson of lifelong value to him.

The life of a tree depends upon its roots. Through them it gets its nourishment. But it is not through those which are large and most visible. It is through the finest roots, and still more the scarcely visible root hairs which are most abundant on the fibrous rootlets. The large roots serve as braces to hold the tree in erect position and keep it from being swayed and overthrown by the winds, and also as conduits through which the water and nourishment gathered by the rootlets are conveyed to the stem and thence to the branches and leaves. The large roots are of no use in securing the life of the newly planted tree or promoting its growth, if the rootlets are broken off or left behind when the tree is taken from its original place.

Hence the need of time and care in undertaking this removal. The roots, even in a young tree, will have spread to a considerable distance from the stem and to follow them and detach them from the soil adhering to them without breaking the tender threads is not easy. It is necessarily a slow though a simple process, and we are apt to be impatient and wish to do the work quickly. But the old proverb, "Haste makes waste," is as true here as anywhere. So is another that "What is worth doing is worth doing well." To plant a tree properly, so that it shall go on to grow vigorously and as though nothing had happened to impair its vitality, instead of barely making a feeble show of life for a while only to have a lingering death, is to give the pupils of a school an object lesson to last them and be of use to them for a lifetime. To make the lesson the more obvious and impressive, let them, under the guidance of the teacher or some one accustomed to handle trees, plant one properly, first preparing the ground where it is to have its new home, by excavating a sufficiently large hole to receive all the roots of the tree with space enough beyond to allow their unimpeded growth for years to come, carefully reducing the earth to such a fine condition that it can be brought into close contact with the smallest roots. Then, having selected the tree beforehand, let it be so taken from the ground as to preserve all the thread-like roots and replaced as soon as possible in the ground prepared for it, the roots being carefully spread out and the fine, soft soil everywhere brought into close contact with them.

Now, to make more clear the advantage of such a planting, it may be well to plant another tree in the way that trees are so commonly planted.

Let some ordinary workman be sent to bring a tree from the woods. He will probably, with three or four thrusts of his sharp spade, sever the main roots of the tree at about the distance of a foot from the stem and then wrench the tree from the ground, rudely breaking off what roots have not been cut already, and will bear off the tree with a triumphant feeling that he was stronger than its "plaguey roots." Then he will make a hole in the ground just large enough to permit him to crowd the lacerated roots into it, with much twisting and turning, and then, heaping upon them the hard, lumpy ground, he will stamp it upon the roots and consider the tree planted, as he will say, perhaps, "in less than no time." It would have been better, probably, if he had not spent even so much time as he has upon it, as the school children will be likely to see to their satisfaction before the summer is over; but they may also learn a lesson in tree planting worth the cost of the life of one tree. It has been stated recently, on good authority, as an illustration of improper planting, that of some hundred trees planted a few years ago on the streets near Morningside Park, New York, every one has died or been removed because of its diseased or dilapidated condition, and replaced by another.

Prof. J. T. Rothrock, forest commissioner of Pennsylvania, in reply to a request for some suggestions in regard to the most profitable observance of Arbor Day, sends the following, bearing on this subject, which is most timely:

In my judgment, one of the most important factors in Arbor Day celebration is space. We have had but few Arbor Day celebrations as yet in this State; yet, as I go over the Commonwealth, I find that already the question presses, Where to plant next year's trees in many of our contracted school grounds? The fact is, we have nowhere in this country recognized as we should how important it is to have large areas attached to our schools. There should be room for all legitimate plays; ample space for a typical, well-grown specimen of each species of native tree. Then, there should be a nursery where each child could plant seeds and nuts of our trees and watch them sprout and push out of the ground and see by what steps they became trees.

Furthermore, this school lot should not be the refuse land of a school district. It should be well situated, have abundant water, and as much variety of soil and exposure as possible. It is clear, if these suggestions have any value, that 5 acres is the least space that any country schoolhouse should have.

It is time for us to recognize the fact that ground dedicated to educational purposes should be as sacred as if set apart for a church. We should look down the coming centuries in forming our plans for it, and anticipate and prepare for a time when mature oaks will transmit the love and traditions of the place from one generation to the next. The school located in such surroundings would soon come to be recognized as a valuable possession. It would be the one cheerful spot in which the whole community had an ownership, the place of deposit of the public library, and the place where the public meetings would be held.

This may all seem utopian. But it is coming. The very hardest lesson for us all to learn is that the world moves faster than we do. More than this, it moves in spite of us, and the next century will probably not be very old before it has moved into a higher appreciation of the value of large and well-kept school grounds. Our successors will feel that space which is too small, and land that is too poor to attempt to raise a crop of grain upon, is also wholly inadequate to the larger work of raising a crop of vigorous, liberal-minded, law-abiding citizens upon.

PLANTING ON LAWNS AND IN PARKS.

After what has been said of planting on streets and school grounds little needs to be added in regard to tree planting on larger spaces, such as lawns, parks, and other open places. The same trees may be used in general, but no such restrictions being necessitated as in the case of street planting, the selection may be made from a greater number of trees. For example, trees whose beauty depends upon their branches starting near the ground, so that the tree will be a solid mass of verdure resting upon the earth's surface, are not appropriate for street planting, where the branches must all be so high from the ground as to admit of unimpeded passage under them. Many other trees also would be misplaced upon a street border which are well adapted for use on a lawn or other open space.

An old Maine homestead.

No such uniformity in size or habit of growth is necessary in the case of lawn or park plantations, as in roadside planting. Landscape effects are here to be sought, and in securing them there is no limit hardly in the choice of trees, except in their adaptation to the soil and climate of the place to be planted. Here, as in all cases of planting, the first choice of trees should be made from those which are indigenous to the locality. This being done, others may be brought from a distance for the sake of increasing variety, or on account of their special merits, care being

taken to procure them from localities corresponding as nearly as may be in climatic and soil conditions to the region where it is proposed to plant them.

AIDS TO SUCCESS IN PLANTING.

It will conduce much to success in planting if trees are procured from nurseries rather than from the woodlands or other uncultivated places. In the nursery grounds the soil is in a light and soft condition, and the trees as they grow are frequently transplanted. This occasions a dense root growth close to the stem, and it enables the tree to be taken from the ground with comparatively little danger of breaking the roots, and the replanting is also accomplished with the greater facility.

Another aid to success, that is, to secure a healthy and vigorous growth of trees, will be found in giving them an ample bed of deeply trenched and well-broken soil when the planting takes place; and if the soil is poor or of too hard and compact a character, by removing it and putting in its place a liberal supply of soil of better structure and abounding in plant food. The present labor and expense involved in doing this will be amply compensated by the appearance of the trees in the subsequent years of their growth. The chief dependence of trees for the promotion of their growth is a sufficient supply of water, out of the constituents of which their bodies are largely built up, and which is the vehicle by means of which the mineral food in the soil is conveyed to all parts of their structure.

It is more important, therefore, that the soil should be of proper physical structure than that it should abound in desirable mineral ingredients. If the soil is hard or clayey, so that water can not penetrate it readily, or if it is coarse-grained and very porous, so that water falling upon it sinks rapidly to the depths below, the roots of trees will fail to obtain such a supply of moisture as is needful for a vigorous growth. They will have but a feeble vitality. Hence the need of having a soil which is of such texture as readily to admit the rains which fall upon it and yet such as to prevent the water from rapidly passing out of reach of the roots. In proportion as the soil is fine it presents a larger surface of moisture to the minute roots of plants.

It will conduce to the proper supply of moisture also if the ground above the tree roots, especially at the first planting, is covered with a mulch of straw or litter of some sort which, by shielding it from sun and wind, will prevent the evaporation of moisture from the soil and to that extent increase the amount at the disposal of the trees. Few understand how much water is removed from the ground by the influence of the sun and winds, especially the latter. One of the chief difficulties in the way of securing a desirable tree growth in many parts of the country, particularly on the Western plains, arises from the prevalence of strong and often hot winds. In the existing forests the trees are protected from the effects of evaporation by the canopy of shade afforded by their leafy tops and by the mulch of fallen leaves accumu-

lated year by year at their base. Where there are not reasons forbidding it we can do nothing better to promote the healthful growth of the trees we plant than to allow the annual fall of leaves to remain upon the ground above the roots and thus form a perpetual mulch of protection for the trees.

METHOD OF PLANTING.

Little is necessary to be added to what has been said in different parts of this pamphlet as to the proper method of planting. The whole matter may be summed up by saying that a tree or plant should be taken from the ground with as little disturbance or impairment of its root system as possible and set in its new place of growth with such care as not to harm its roots, but to bring them all into close contact with the soil, by pressing it firmly around and upon them, thus giving them opportunity at every point to absorb from the particles of soil the moisture necessary for the steady and healthful growth of the tree, and leaving no vacant spaces to promote decay or lessen the supply of moisture. This is the most important thing to be secured. Care should be taken also in conveying the tree from the place from which it is taken to the place of planting not to allow the roots to become dry by exposure either to the sun or the wind. Especially should it be so in the case of evergreen trees, which have a resinous sap. If this sap becomes hardened by exposure to sun or wind, it is nearly impossible to restore its fluid condition so that it will perform its part in the circulatory system, and the tree may be considered dead already.

OPINIONS OF REPRESENTATIVE MEN.

The State of Nebraska having, a few years ago, made its Arbor Day to coincide with Mr. Morton's birthday, the editor of one of its newspapers issued, in 1888, a special Arbor Day number of his paper. Prominent among the features of that issue was a collection of letters received, in response to the editor's invitation, from a large number of persons distinguished in public life or otherwise, expressing their appreciation of Arbor Day and their regard for its author. It seemed that the sentiments therein expressed, which so justly set forth the merits and importance of Arbor Day, ought on that account to have a place in the present publication. Portions of a few of the many letters received are therefore inserted here:

I willingly confess so great a partiality for trees as tempts me to respect a man in exact proportion to his respect for them. He can not be wholly bad who has a sympathy with what is so innocent and so beautiful. But quite apart from any sentimental consideration, the influence of trees upon climate and rainfall gives to

the planting of trees, and to the protection of them where nature has already planted them, a national importance. Our wicked wastefulness and contempt for the teaching of science in this matter will most surely be avenged on our descendants. Nature may not instantly rebuke, but she never forgives, the breach of her laws.

I am glad, therefore, to join in this tribute of friendly gratitude to the inventor of Arbor Day. I think that no man does anything more visibly useful to posterity than he who plants a tree. I should answer the cynic's question, "What has posterity done for me that I should do anything for it?" by saying that it is all the pleasanter to do something for those who can do nothing for us.

Marco Polo relates that the great Kublai Khan planted trees the more willingly because "his astrologers and diviners told him that they who planted trees lived long." Let me hope that this may prove true in the case of Mr. Morton.—James Russell Lowell.

No instructed agriculturist is unacquainted with the ameliorating influence on climate, rainfall, freshet, windstorms, etc., produced by the liberal planting of trees on waste lands. The cheering thing has been that the same wise ideas have crept into the minds of our people and made them set resolutely to work in carrying out the simple, practical, and benignant suggestion of Mr. Morton.

An essay might be written on this topic by any thoughtful man acquainted with the phenomena of meteorology, and if Mr. Morton's plan shall be persevered in by the whole country, nature herself will write that essay in beautiful style before a quarter of a century is passed.—George H. Boker.

The best and highest thing a man can do in a day is to sow a seed, whether it be in the shape of a word, an act, or an acorn. Last year, on less than half an acre of ground, at my summer home by the seaside at Hull, I planted 227 individual lives, of creeper, shrubs, and tree. All through the winter, from the city, my mind reached out, as it were, to observe and care for the young things in their strange soil. Last week I went to see them, and Mr. Morton will know the thrill of pleasure, unlike all other pleasures, which came from the signs of health and growth in the plants.—John Boyle O'Reilly.

It is not very long since, especially in the Eastern States, when the enemy of the tree was considered the friend of the human race, but the time has now come when the friend of the tree is the friend of the race.

Mr. Morton deserves the gratitude of the whole land. How many naked spots on this vast continent will be clothed in verdure by reason of his happy suggestion! The birds and animals, as well as the people, profit by his wise forethought. Every tree planted upon this day will serve to keep green his memory.—John Burroughs.

If, as has been wisely said, he is a public benefactor who causes two blades of grass to grow where only one grew before, we well may honor the man to whom his country will owe, in the near future, so many beautiful groves and orchards and trees, blessing with their shade its village streets.—J. T. Trowbridge.

Most of the States have sinking funds with which to provide for debts not yet due. It would be a simple and wise policy for a State to invest a considerable sum annually from its sinking fund in forest. Individuals hesitate about a form of investment which does not pay for many years. A State need not hesitate, because it does not need the money for many years. A State has also the power to make and enforce the laws which will protect its forests.—Edward Everett Hale.

The practice of systematic tree planting is a most excellent one, and those who have encouraged and promoted it deserve well of their country. I am very glad that the West has been roused to a sense of the importance of planting trees, and hope that all parts of the country will soon feel the necessity of preserving them.—Francis Parkman.

The material benefits of Arbor Day alone are incalculable, for it makes the barren land fertile and the desert plain green with beauty.

But these material benefits, great as they are, are small compared with the moral effect on the mind and heart of the people. In the young, especially, it enriches the taste, cultivates the love of beauty, and provides pleasant, healthful impressions that never will be obliterated. The love of trees, I think, has a more elevating effect than even the love of flowers; it is more strong and invigorating.

Besides all these immediate benefits, Arbor Day reaches far beyond the localities where it is observed. The young, gathered in certain sections, eventually become scattered and have homes of their own. The influence of this day will follow them there, and under the influence of their early cherished impressions trees will be planted, not only around their dwellings, but along the roads and water courses of the place in which they live, and thus cover the land with beauty and blessing.

All honor, then, to the founder of Arbor Day. The sculptor's art could not erect so noble a monument to his memory as loving hands and hearts are rearing and shall rear to it all over this barren land.—J. T. Headley.

All lovers of nature may well rejoice in the establishment of Arbor Day, and join in doing honor to the founder of an institution so beneficent.—Thomas Wentworth Higginson.

Whatever makes a village or town more attractive promotes that local pride and public spirit which are the vital and conservative forces of a great republic; and, if the planter of one shade tree is a public benefactor, what shall we say of him who stimulates the planting of whole groves and forests?—George William Curtis.

The observance of Arbor Day is aiding in bringing about a realization of the needs of our forestry interests, and will ultimately make the whole country equal to the occasion of a methodical, systematic forestry management.—B. E. Fernow.

Many people, often among the most intelligent, when they first hear of Arbor Day, look upon it as a kind of sentimental feast quite out of date in our matter-of-fact generation, but upon a closer inspection they soon discover its practical value.—H. G. Joly.

Prior to 1872 no system of forestry had been attempted in the United States. The spasmodic efforts of tree planting upon a small scale, with very rare exceptions, were attended with the most unsatisfactory results.

Forests were cut away without system and without thought of future condition or wants until it was self-evident that unless some judicious and comprehensive forest policy was adopted, this continent, once bristling with its primeval forests, would be permanently deprived of an element which constitutes a most important part in the economy of nature.

Forestry, no less than science, is a development of civilization. Colbert was instrumental in preventing the useless waste of the forests of the old world, but the honor of bequeathing to future generations an invaluable legacy of the perpetuation of forests was reserved for a philanthropist of a more advanced age.

There is no State in the Union but needs such a legacy, and when that which is now observed in twenty-eight States becomes a national holiday, then will each citizen have left to him and to his heirs forever, under a seal greater than that of Cæsar's, "private arbors and new-planted orchards."

If a John Howard, ameliorating the evils of convict life and alleviating the sufferings of prisoners, can be called the "world's philanthropist," surely he who originates measures which tend directly to the improvement and fertility of the land and the wealth and comfort of the inhabitants, adding as many dollars to the world's exchequer as the mines of uncoined ore produce, and more rays to the brightness of the world's civilization than the electric spark has generated, is not least among fellow men.—A. J. Sawyer.

No man now living has done more to beautify and enrich his State and country than he. Millions upon millions of green and living monuments attest his forethought and his worth; and as these trees grow and expand in beauty, so will the love of this great benefactor increase in the hearts of our people.—John B. Peaslee.

The wisdom and pertinency of Jonathan Swift's saying may now well be recalled: "And he gave for his opinion that whoever could make two ears of corn or two blades of grass to grow on a spot of ground where only one grew before would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together."

If this were true of two ears of corn or blades of grass, how much more of a tree.—T. F. Bayard.

Tribute of fruits be his, and glossy wreaths
From roadside trees, and his the people's love,
When east and west the wind of summer breathes
Through orchard, shaded path, and sighing grove.
—[E. C. Stedman.

SUGGESTIONS FOR PROGRAMMES.

It is not necessary to give even a specimen programme for the observance of Arbor Day. If any attention to the subject is given beforehand a teacher can hardly fail to arrange a scheme of exercises that will be both interesting and profitable, and the pupils will not be slow to offer suggestions which will be worthy of consideration, and the more they are allowed to have a voice in the arrangements the more interested will they be in the actual doings of the day, and the more beneficial also will these be to them.

The exercises will naturally begin with the reading of the proclamation of the governor of the State or of the superintendent of public instruction, by which the day is fixed, or by the law setting apart the day for special uses. Any or all of these may be read. They will give dignity and impressiveness to the whole service. One or more selections from the Bible, indicating the high moral and religious lessons which the trees afford and the conspicuous place which they have in our sacred Scriptures, may fitly follow.

Other particular features of the Arbor Day exercises will be determined by the character of the school, the age of the pupils, the studies they are commonly engaged with, and various other considerations.

Teachers will bear in mind that the observance of Arbor Day has behind it a serious purpose, and that it is not simply an occasion for the children "to have a good time." It looks to their education in what is highest and noblest, to bring their minds into contact with the best thoughts of other minds, and kindle in them the purest and best feelings. It aims to open their hearts to the sweet and precious lessons which come from intercourse with nature, to make them unselfish, con-

siderate of one another and of all around them, and to prepare them to lead noble and useful lives.

In view of the duties of citizenship which are soon to devolve upon them care should be taken to make the patriotic feature of the exercises for Arbor Day prominent. Trees should be planted in memory of men who have nobly served their country. Patriotic songs should be sung, and the national flag should be displayed in the schoolhouse and on the march to plant the trees. Selections abounding in patriotic sentiments should also be read or recited. We have given a few specimens of appropriate character from various authors and have made reference to more, but the pupils should be encouraged to find others still.

The endeavor should be made to give the exercises a varied character, adapting them to the younger pupils not less than to the older. On this account songs and recitations of light and seemingly, perhaps, of somewhat trivial character may be allowed a place in company with those of higher grade. Let the youngest pupils become interested in Arbor Day as soon as possible, if it be only at first by songs of birds and flowers.

The programme for the day's observance will be imperfect if it does not include as one of its items an account given by some pupil of the object of Arbor Day, describing its origin and purpose, and the ends which are sought to be accomplished by it. This should be kept in mind by distinct reference to it from year to year.

In places so large that the schools can not well be combined in celebrating Arbor Day it will conduce to the greater interest and resulting benefit of the exercises if a generous rivalry is stimulated between the schools in the endeavor to see which will have the most interesting and pleasing programme.

Many schools have been accustomed to adopt by vote some tree as their emblematic tree or badge. This naturally causes the pupils to give special attention to that particular tree and on Arbor Day to make it the subject of essays, recitations, and songs, thus giving it the chief place in the exercises. The result may easily be made to be such a knowledge of that particular tree as will be pleasant and valuable for a lifetime. The choice of other trees in the same way from year to year will form a very pleasing method of learning to distinguish the various species of trees from each other and to know their habits and uses.

It is desirable that an address, or more than one, by some thoughtful person, invited for the occasion, should form a feature of the day's exercises. But the pupils should be expected to furnish essays for the occasion on appropriate subjects, and to prepare them carefully. There is given in this bulletin a considerable list of such subjects, but one by no means exhaustive, only suggestive of the many which readily offer themselves for consideration.

Then there is a large field for recitations and declamations appropriate for the day. A considerable number of such may be gathered from the essays in the earlier part of this publication, but our literature abounds with them, and teachers should encourage their pupils to become familiar with them, committing many of them to memory, thereby enriching their minds with gems of thought to be their delightful possession for life and a constant incentive to what is noblest, purest, and best.

MISCELLANEOUS READINGS.

We can hardly see or think of trees without being reminded of Mr. Lowell. He was eminently a lover of trees, and they were the inspiration of some of his best prose and poetry. This love of trees led him to call his pleasant place of residence, in Cambridge, "Elmwood." And no memorial of him would be more accordant with his own feelings than a growing tree. This is abundantly shown by the following letter, written only a few years ago, when it was proposed in one of our schools to plant on Arbor Day a tree in his memory:

"I can think of no more pleasant way of being remembered than by the planting of a tree. Like whatever things are perennially good, it will be growing while we are sleeping, and will survive us to make others happier. Birds will rest in it and fly thence with messages of good cheer. I should be glad to think that any word or deed of mine could be such a perennial presence of beauty, or show so benign a destiny."

THE OAK.

What gnarled stretch, what depth of shade is his?
  There needs no crown to mark the forest's king;
How in his leaves outshines full summer's bliss!
  Sun, storm, rain, dew, to him their tribute bring,
Which he, with such benignant royalty
  Accepts, as overpayeth what is lent;
All nature seems his vassal proud to be,
  And cunning only for his ornament.

How towers he, too, amid the billowed snows,
  An unquelled exile from the summer's throne,
Whose plain, uncinctured front more kingly shows,
  Now that the obscuring courtier leaves are flown.
His boughs make music of the winter air,
  Jeweled with sleet, like some cathedral front
Where clinging snowflakes, with quaint art, repair
  The dents and furrows of Time's envious brunt.

How doth his patient strength the rude March wind
  Persuade to seem glad breaths of summer breeze,
And win the soil that fain would be unkind,
  To swell his revenues with proud increase!
He is the gem; and all the landscape wide
  (So doth his grandeur isolate the sense)
Seems but the setting, worthless all beside,
  An empty socket, were he fallen thence.

So, from oft converse with life's wintry gales,
  Should man learn how to clasp with tougher roots
The inspiring earth—how otherwise avails
  The leaf-creating sap that sunward shoots?
So every year that falls with noiseless flake
  Should fill old scars up on the stormward side,
And make hoar age revered for age's sake,
  Not for traditions of youth's leafy pride.

With many persons a tree is a tree, and peculiarities of nature or habit of growth are taken little account of. It is enough also with many, in planting, if a hole is made in the ground and the roots of the tree, many or few, are thrust into it and hastily covered with earth again. One of the most difficult things to do is to get a tree properly planted, and yet tree planting is a very simple thing. It consists in taking a tree out of the ground without injury and placing it in the ground again in another place also without injury, and with a corresponding connection with the soil such as it had before. This simply requires time, patience, and care. Yet in planting a single tree a boy may learn a lesson of lifelong value to him.

The life of a tree depends upon its roots. Through them it gets its nourishment. But it is not through those which are large and most visible. It is through the finest roots, and still more the scarcely visible root hairs which are most abundant on the fibrous rootlets. The large roots serve as braces to hold the tree in erect position and keep it from being swayed and overthrown by the winds, and also as conduits through which the water and nourishment gathered by the rootlets are conveyed to the stem and thence to the branches and leaves. The large roots are of no use in securing the life of the newly planted tree or promoting its growth, if the rootlets are broken off or left behind when the tree is taken from its original place.

Hence the need of time and care in undertaking this removal. The roots, even in a young tree, will have spread to a considerable distance from the stem and to follow them and detach them from the soil adhering to them without breaking the tender threads is not easy. It is necessarily a slow though a simple process, and we are apt to be impatient and wish to do the work quickly. But the old proverb, "Haste makes waste," is as true here as anywhere. So is another that "What is worth doing is worth doing well." To plant a tree properly, so that it shall go on to grow vigorously and as though nothing had happened to impair its vitality, instead of barely making a feeble show of life for a while only to have a lingering death, is to give the pupils of a school an object lesson to last them and be of use to them for a lifetime. To make the lesson the more obvious and impressive, let them, under the guidance of the teacher or some one accustomed to handle trees, plant one properly, first preparing the ground where it is to have its new home, by excavating a sufficiently large hole to receive all the roots of the tree with space enough beyond to allow their unimpeded growth for years to come, carefully reducing the earth to such a fine condition that it can be brought into close contact with the smallest roots. Then, having selected the tree beforehand, let it be so taken from the ground as to preserve all the thread-like roots and replaced as soon as possible in the ground prepared for it, the roots being carefully spread out and the fine, soft soil everywhere brought into close contact with them.

Now, to make more clear the advantage of such a planting, it may be well to plant another tree in the way that trees are so commonly planted.

Let some ordinary workman be sent to bring a tree from the woods. He will probably, with three or four thrusts of his sharp spade, sever the main roots of the tree at about the distance of a foot from the stem and then wrench the tree from the ground, rudely breaking off what roots have not been cut already, and will bear off the tree with a triumphant feeling that he was stronger than its "plaguey roots." Then he will make a hole in the ground just large enough to permit him to crowd the lacerated roots into it, with much twisting and turning, and then, heaping upon them the hard, lumpy ground, he will stamp it upon the roots and consider the tree planted, as he will say, perhaps, "in less than no time." It would have been better, probably, if he had not spent even so much time as he has upon it, as the school children will be likely to see to their satisfaction before the summer is over; but they may also learn a lesson in tree planting worth the cost of the life of one tree. It has been stated recently, on good authority, as an illustration of improper planting, that of some hundred trees planted a few years ago on the streets near Morningside Park, New York, every one has died or been removed because of its diseased or dilapidated contion, and replaced by another.

Prof. J. T. Rothrock, forest commissioner of Pennsylvania, in reply to a request for some suggestions in regard to the most profitable observance of Arbor Day, sends the following, bearing on this subject, which is most timely:

In my judgment, one of the most important factors in Arbor Day celebration is space. We have had but few Arbor Day celebrations as yet in this State; yet, as I go over the Commonwealth, I find that already the question presses, Where to plant next year's trees in many of our contracted school grounds? The fact is, we have nowhere in this country recognized as we should how important it is to have large areas attached to our schools. There should be room for all legitimate plays; ample space for a typical, well-grown specimen of each species of native tree. Then, there should be a nursery where each child could plant seeds and nuts of our trees and watch them sprout and push out of the ground and see by what steps they became trees.

Furthermore, this school lot should not be the refuse land of a school district. It should be well situated, have abundant water, and as much variety of soil and exposure as possible. It is clear, if these suggestions have any value, that 5 acres is the least space that any country schoolhouse should have.

It is time for us to recognize the fact that ground dedicated to educational purposes should be as sacred as if set apart for a church. We should look down the coming centuries in forming our plans for it, and anticipate and prepare for a time when mature oaks will transmit the love and traditions of the place from one generation to the next. The school located in such surroundings would soon come to be recognized as a valuable possession. It would be the one cheerful spot in which the whole community had an ownership, the place of deposit of the public library, and the place where the public meetings would be held.

This may all seem utopian. But it is coming. The very hardest lesson for us all to learn is that the world moves faster than we do. More than this, it moves in spite of us, and the next century will probably not be very old before it has moved into a higher appreciation of the value of large and well-kept school grounds. Our successors will feel that space which is too small, and land that is too poor to attempt to raise a crop of grain upon, is also wholly inadequate to the larger work of raising a crop of vigorous, liberal-minded, law-abiding citizens upon.

PLANTING ON LAWNS AND IN PARKS.

After what has been said of planting on streets and school grounds little needs to be added in regard to tree planting on larger spaces, such as lawns, parks, and other open places. The same trees may be used in general, but no such restrictions being necessitated as in the case of street planting, the selection may be made from a greater number of trees. For example, trees whose beauty depends upon their branches starting near the ground, so that the tree will be a solid mass of verdure resting upon the earth's surface, are not appropriate for street planting, where the branches must all be so high from the ground as to admit of unimpeded passage under them. Many other trees also would be misplaced upon a street border which are well adapted for use on a lawn or other open space.

An old Maine homestead.

No such uniformity in size or habit of growth is necessary in the case of lawn or park plantations, as in roadside planting. Landscape effects are here to be sought, and in securing them there is no limit hardly in the choice of trees, except in their adaptation to the soil and climate of the place to be planted. Here, as in all cases of planting, the first choice of trees should be made from those which are indigenous to the locality. This being done, others may be brought from a distance for the sake of increasing variety, or on account of their special merits, care being

taken to procure them from localities corresponding as nearly as may be in climatic and soil conditions to the region where it is proposed to plant them.

AIDS TO SUCCESS IN PLANTING.

It will conduce much to success in planting if trees are procured from nurseries rather than from the woodlands or other uncultivated places. In the nursery grounds the soil is in a light and soft condition, and the trees as they grow are frequently transplanted. This occasions a dense root growth close to the stem, and it enables the tree to be taken from the ground with comparatively little danger of breaking the roots, and the replanting is also accomplished with the greater facility.

Another aid to success, that is, to secure a healthy and vigorous growth of trees, will be found in giving them an ample bed of deeply trenched and well-broken soil when the planting takes place; and if the soil is poor or of too hard and compact a character, by removing it and putting in its place a liberal supply of soil of better structure and abounding in plant food. The present labor and expense involved in doing this will be amply compensated by the appearance of the trees in the subsequent years of their growth. The chief dependence of trees for the promotion of their growth is a sufficient supply of water, out of the constituents of which their bodies are largely built up, and which is the vehicle by means of which the mineral food in the soil is conveyed to all parts of their structure.

It is more important, therefore, that the soil should be of proper physical structure than that it should abound in desirable mineral ingredients. If the soil is hard or clayey, so that water can not penetrate it readily, or if it is coarse-grained and very porous, so that water falling upon it sinks rapidly to the depths below, the roots of trees will fail to obtain such a supply of moisture as is needful for a vigorous growth. They will have but a feeble vitality. Hence the need of having a soil which is of such texture as readily to admit the rains which fall upon it and yet such as to prevent the water from rapidly passing out of reach of the roots. In proportion as the soil is fine it presents a larger surface of moisture to the minute roots of plants.

It will conduce to the proper supply of moisture also if the ground above the tree roots, especially at the first planting, is covered with a mulch of straw or litter of some sort which, by shielding it from sun and wind, will prevent the evaporation of moisture from the soil and to that extent increase the amount at the disposal of the trees. Few understand how much water is removed from the ground by the influence of the sun and winds, especially the latter. One of the chief difficulties in the way of securing a desirable tree growth in many parts of the country, particularly on the Western plains, arises from the prevalence of strong and often hot winds. In the existing forests the trees are protected from the effects of evaporation by the canopy of shade afforded by their leafy tops and by the mulch of fallen leaves accumu-

lated year by year at their base. Where there are not reasons forbidding it we can do nothing better to promote the healthful growth of the trees we plant than to allow the annual fall of leaves to remain upon the ground above the roots and thus form a perpetual mulch of protection for the trees.

METHOD OF PLANTING.

Little is necessary to be added to what has been said in different parts of this pamphlet as to the proper method of planting. The whole matter may be summed up by saying that a tree or plant should be taken from the ground with as little disturbance or impairment of its root system as possible and set in its new place of growth with such care as not to harm its roots, but to bring them all into close contact with the soil, by pressing it firmly around and upon them, thus giving them opportunity at every point to absorb from the particles of soil the moisture necessary for the steady and healthful growth of the tree, and leaving no vacant spaces to promote decay or lessen the supply of moisture. This is the most important thing to be secured. Care should be taken also in conveying the tree from the place from which it is taken to the place of planting not to allow the roots to become dry by exposure either to the sun or the wind. Especially should it be so in the case of evergreen trees, which have a resinous sap. If this sap becomes hardened by exposure to sun or wind, it is nearly impossible to restore its fluid condition so that it will perform its part in the circulatory system, and the tree may be considered dead already.

OPINIONS OF REPRESENTATIVE MEN.

The State of Nebraska having, a few years ago, made its Arbor Day to coincide with Mr. Morton's birthday, the editor of one of its newspapers issued, in 1888, a special Arbor Day number of his paper. Prominent among the features of that issue was a collection of letters received, in response to the editor's invitation, from a large number of persons distinguished in public life or otherwise, expressing their appreciation of Arbor Day and their regard for its author. It seemed that the sentiments therein expressed, which so justly set forth the merits and importance of Arbor Day, ought on that account to have a place in the present publication. Portions of a few of the many letters received are therefore inserted here:

I willingly confess so great a partiality for trees as tempts me to respect a man in exact proportion to his respect for them. He can not be wholly bad who has a sympathy with what is so innocent and so beautiful. But quite apart from any sentimental consideration, the influence of trees upon climate and rainfall gives to

the planting of trees, and to the protection of them where nature has already planted them, a national importance. Our wicked wastefulness and contempt for the teaching of science in this matter will most surely be avenged on our descendants. Nature may not instantly rebuke, but she never forgives, the breach of her laws.

I am glad, therefore, to join in this tribute of friendly gratitude to the inventor of Arbor Day. I think that no man does anything more visibly useful to posterity than he who plants a tree. I should answer the cynic's question, "What has posterity done for me that I should do anything for it?" by saying that it is all the pleasanter to do something for those who can do nothing for us.

Marco Polo relates that the great Kublai Khan planted trees the more willingly because "his astrologers and diviners told him that they who planted trees lived long." Let me hope that this may prove true in the case of Mr. Morton.—James Russell Lowell.

No instructed agriculturist is unacquainted with the ameliorating influence on climate, rainfall, freshet, windstorms, etc., produced by the liberal planting of trees on waste lands. The cheering thing has been that the same wise ideas have crept into the minds of our people and made them set resolutely to work in carrying out the simple, practical, and benignant suggestion of Mr. Morton.

An essay might be written on this topic by any thoughtful man acquainted with the phenomena of meteorology, and if Mr. Morton's plan shall be persevered in by the whole country, nature herself will write that essay in beautiful style before a quarter of a century is passed.—George H. Boker.

The best and highest thing a man can do in a day is to sow a seed, whether it be in the shape of a word, an act, or an acorn. Last year, on less than half an acre of ground, at my summer home by the seaside at Hull, I planted 227 individual lives, of creeper, shrubs, and tree. All through the winter, from the city, my mind reached out, as it were, to observe and care for the young things in their strange soil. Last week I went to see them, and Mr. Morton will know the thrill of pleasure, unlike all other pleasures, which came from the signs of health and growth in the plants.—John Boyle O'Reilly.

It is not very long since, especially in the Eastern States, when the enemy of the tree was considered the friend of the human race, but the time has now come when the friend of the tree is the friend of the race.

Mr. Morton deserves the gratitude of the whole land. How many naked spots on this vast continent will be clothed in verdure by reason of his happy suggestion! The birds and animals, as well as the people, profit by his wise forethought. Every tree planted upon this day will serve to keep green his memory.—John Burroughs.

If, as has been wisely said, he is a public benefactor who causes two blades of grass to grow where only one grew before, we well may honor the man to whom his country will owe, in the near future, so many beautiful groves and orchards and trees, blessing with their shade its village streets.—J. T. Trowbridge.

Most of the States have sinking funds with which to provide for debts not yet due. It would be a simple and wise policy for a State to invest a considerable sum annually from its sinking fund in forest. Individuals hesitate about a form of investment which does not pay for many years. A State need not hesitate, because it does not need the money for many years. A State has also the power to make and enforce the laws which will protect its forests.—Edward Everett Hale.

The practice of systematic tree planting is a most excellent one, and those who have encouraged and promoted it deserve well of their country. I am very glad that the West has been roused to a sense of the importance of planting trees, and hope that all parts of the country will soon feel the necessity of preserving them.—Francis Parkman.

The material benefits of Arbor Day alone are incalculable, for it makes the barren land fertile and the desert plain green with beauty.

But these material benefits, great as they are, are small compared with the moral effect on the mind and heart of the people. In the young, especially, it enriches the taste, cultivates the love of beauty, and provides pleasant, healthful impressions that never will be obliterated. The love of trees, I think, has a more elevating effect than even the love of flowers; it is more strong and invigorating.

Besides all these immediate benefits, Arbor Day reaches far beyond the localities where it is observed. The young, gathered in certain sections, eventually become scattered and have homes of their own. The influence of this day will follow them there, and under the influence of their early cherished impressions trees will be planted, not only around their dwellings, but along the roads and water courses of the place in which they live, and thus cover the land with beauty and blessing.

All honor, then, to the founder of Arbor Day. The sculptor's art could not erect so noble a monument to his memory as loving hands and hearts are rearing and shall rear to it all over this barren land.—J. T. Headley.

All lovers of nature may well rejoice in the establishment of Arbor Day, and join in doing honor to the founder of an institution so beneficent.—Thomas Wentworth Higginson.

Whatever makes a village or town more attractive promotes that local pride and public spirit which are the vital and conservative forces of a great republic; and, if the planter of one shade tree is a public benefactor, what shall we say of him who stimulates the planting of whole groves and forests?—George William Curtis.

The observance of Arbor Day is aiding in bringing about a realization of the needs of our forestry interests, and will ultimately make the whole country equal to the occasion of a methodical, systematic forestry management.—B. E. Fernow.

Many people, often among the most intelligent, when they first hear of Arbor Day, look upon it as a kind of sentimental feast quite out of date in our matter-of-fact generation, but upon a closer inspection they soon discover its practical value.—H. G. Joly.

Prior to 1872 no system of forestry had been attempted in the United States. The spasmodic efforts of tree planting upon a small scale, with very rare exceptions, were attended with the most unsatisfactory results.

Forests were cut away without system and without thought of future condition or wants until it was self-evident that unless some judicious and comprehensive forest policy was adopted, this continent, once bristling with its primeval forests, would be permanently deprived of an element which constitutes a most important part in the economy of nature.

Forestry, no less than science, is a development of civilization. Colbert was instrumental in preventing the useless waste of the forests of the old world, but the honor of bequeathing to future generations an invaluable legacy of the perpetuation of forests was reserved for a philanthropist of a more advanced age.

There is no State in the Union but needs such a legacy, and when that which is now observed in twenty-eight States becomes a national holiday, then will each citizen have left to him and to his heirs forever, under a seal greater than that of Cæsar's, "private arbors and new-planted orchards."

If a John Howard, ameliorating the evils of convict life and alleviating the sufferings of prisoners, can be called the "world's philanthropist," surely he who originates measures which tend directly to the improvement and fertility of the land and the wealth and comfort of the inhabitants, adding as many dollars to the world's exchequer as the mines of uncoined ore produce, and more rays to the brightness of the world's civilization than the electric spark has generated, is not least among fellow men.—A. J. Sawyer.

No man now living has done more to beautify and enrich his State and country than he. Millions upon millions of green and living monuments attest his forethought and his worth; and as these trees grow and expand in beauty, so will the love of this great benefactor increase in the hearts of our people.—John B. Peaslee.

The wisdom and pertinency of Jonathan Swift's saying may now well be recalled: "And he gave for his opinion that whoever could make two ears of corn or two blades of grass to grow on a spot of ground where only one grew before would deserve better of mankind, and do more essential service to his country than the whole race of politicians put together."

If this were true of two ears of corn or blades of grass, how much more of a tree.—T. F. Bayard.

Tribute of fruits be his, and glossy wreaths
From roadside trees, and his the people's love,
When east and west the wind of summer breathes
Through orchard, shaded path, and sighing grove.
—[E. C. Stedman.

SUGGESTIONS FOR PROGRAMMES.

It is not necessary to give even a specimen programme for the observance of Arbor Day. If any attention to the subject is given beforehand a teacher can hardly fail to arrange a scheme of exercises that will be both interesting and profitable, and the pupils will not be slow to offer suggestions which will be worthy of consideration, and the more they are allowed to have a voice in the arrangements the more interested will they be in the actual doings of the day, and the more beneficial also will these be to them.

The exercises will naturally begin with the reading of the proclamation of the governor of the State or of the superintendent of public instruction, by which the day is fixed, or by the law setting apart the day for special uses. Any or all of these may be read. They will give dignity and impressiveness to the whole service. One or more selections from the Bible, indicating the high moral and religious lessons which the trees afford and the conspicuous place which they have in our sacred Scriptures, may fitly follow.

Other particular features of the Arbor Day exercises will be determined by the character of the school, the age of the pupils, the studies they are commonly engaged with, and various other considerations.

Teachers will bear in mind that the observance of Arbor Day has behind it a serious purpose, and that it is not simply an occasion for the children "to have a good time." It looks to their education in what is highest and noblest, to bring their minds into contact with the best thoughts of other minds, and kindle in them the purest and best feelings. It aims to open their hearts to the sweet and precious lessons which come from intercourse with nature, to make them unselfish, con-

siderate of one another and of all around them, and to prepare them to lead noble and useful lives.

In view of the duties of citizenship which are soon to devolve upon them care should be taken to make the patriotic feature of the exercises for Arbor Day prominent. Trees should be planted in memory of men who have nobly served their country. Patriotic songs should be sung, and the national flag should be displayed in the schoolhouse and on the march to plant the trees. Selections abounding in patriotic sentiments should also be read or recited. We have given a few specimens of appropriate character from various authors and have made reference to more, but the pupils should be encouraged to find others still.

The endeavor should be made to give the exercises a varied character, adapting them to the younger pupils not less than to the older. On this account songs and recitations of light and seemingly, perhaps, of somewhat trivial character may be allowed a place in company with those of higher grade. Let the youngest pupils become interested in Arbor Day as soon as possible, if it be only at first by songs of birds and flowers.

The programme for the day's observance will be imperfect if it does not include as one of its items an account given by some pupil of the object of Arbor Day, describing its origin and purpose, and the ends which are sought to be accomplished by it. This should be kept in mind by distinct reference to it from year to year.

In places so large that the schools can not well be combined in celebrating Arbor Day it will conduce to the greater interest and resulting benefit of the exercises if a generous rivalry is stimulated between the schools in the endeavor to see which will have the most interesting and pleasing programme.

Many schools have been accustomed to adopt by vote some tree as their emblematic tree or badge. This naturally causes the pupils to give special attention to that particular tree and on Arbor Day to make it the subject of essays, recitations, and songs, thus giving it the chief place in the exercises. The result may easily be made to be such a knowledge of that particular tree as will be pleasant and valuable for a lifetime. The choice of other trees in the same way from year to year will form a very pleasing method of learning to distinguish the various species of trees from each other and to know their habits and uses.

It is desirable that an address, or more than one, by some thoughtful person, invited for the occasion, should form a feature of the day's exercises. But the pupils should be expected to furnish essays for the occasion on appropriate subjects, and to prepare them carefully. There is given in this bulletin a considerable list of such subjects, but one by no means exhaustive, only suggestive of the many which readily offer themselves for consideration.

Then there is a large field for recitations and declamations appropriate for the day. A considerable number of such may be gathered from the essays in the earlier part of this publication, but our literature abounds with them, and teachers should encourage their pupils to become familiar with them, committing many of them to memory, thereby enriching their minds with gems of thought to be their delightful possession for life and a constant incentive to what is noblest, purest, and best.

MISCELLANEOUS READINGS.

We can hardly see or think of trees without being reminded of Mr. Lowell. He was eminently a lover of trees, and they were the inspiration of some of his best prose and poetry. This love of trees led him to call his pleasant place of residence, in Cambridge, "Elmwood." And no memorial of him would be more accordant with his own feelings than a growing tree. This is abundantly shown by the following letter, written only a few years ago, when it was proposed in one of our schools to plant on Arbor Day a tree in his memory:

"I can think of no more pleasant way of being remembered than by the planting of a tree. Like whatever things are perennially good, it will be growing while we are sleeping, and will survive us to make others happier. Birds will rest in it and fly thence with messages of good cheer. I should be glad to think that any word or deed of mine could be such a perennial presence of beauty, or show so benign a destiny."

THE OAK.

What gnarled stretch, what depth of shade is his?
  There needs no crown to mark the forest's king;
How in his leaves outshines full summer's bliss!
  Sun, storm, rain, dew, to him their tribute bring,
Which he, with such benignant royalty
  Accepts, as overpayeth what is lent;
All nature seems his vassal proud to be,
  And cunning only for his ornament.

How towers he, too, amid the billowed snows,
  An unquelled exile from the summer's throne,
Whose plain, uncinctured front more kingly shows,
  Now that the obscuring courtier leaves are flown.
His boughs make music of the winter air,
  Jeweled with sleet, like some cathedral front
Where clinging snowflakes, with quaint art, repair
  The dents and furrows of Time's envious brunt.

How doth his patient strength the rude March wind
  Persuade to seem glad breaths of summer breeze,
And win the soil that fain would be unkind,
  To swell his revenues with proud increase!
He is the gem; and all the landscape wide
  (So doth his grandeur isolate the sense)
Seems but the setting, worthless all beside,
  An empty socket, were he fallen thence.

So, from oft converse with life's wintry gales,
  Should man learn how to clasp with tougher roots
The inspiring earth—how otherwise avails
  The leaf-creating sap that sunward shoots?
So every year that falls with noiseless flake
  Should fill old scars up on the stormward side,
And make hoar age revered for age's sake,
  Not for traditions of youth's leafy pride.

So, from the pinched soil of a churlish fate,
True hearts compel the sap of sturdier growth,
So between earth and heaven stand simply great,
That these shall seem but their attendants both;
For nature's forces, with obedient zeal
Wait on the rooted faith and oaken will,
As quickly the pretender's cheat they feel,
And turn mad Pucks to flout and mock him still.

Lord! all Thy works are lessons—each contains
Some emblem of man's all-containing soul;
Shall he make fruitless all Thy glorious pains,
Delving within Thy grace an eyeless mole?
Make me the least of Thy Dodona-grove,
Cause me some message of Thy truth to bring,
Speak but a word through me, nor let Thy love
Among my boughs disdain to perch and sing.

—[James Russell Lowell.

Live oak tree, Audubon Park, New Orleans, antedating the settlement of that country.

UNDER THE WILLOWS.

This willow is as old to me as life;
And under it full often have I stretched,
Feeling the warm earth like a thing alive,
And gathering virtue in at every pore
Till it possessed me wholly, and thought ceased,
Or was transfused in something to which thought
Is coarse and dull of sense. Myself was lost,
Gone from me like an ache, and what remained
Became a part of the universal joy.
My soul went forth, and, mingling with the tree,
Danced in the leaves; or, floating in the cloud,
Saw its white double in the stream below.

* * * * *

—[Lowell.

BENEATH THE SHADOW OF OAKS.

I thank heaven every summer's day of my life that my lot was humbly cast within the hearing of romping brooks, and beneath the shadow of oaks, and away from all the tramp and bustle of the world, into which fortune has led me in these latter years of my life. I delight to steal away for days and for weeks together, and bathe my spirit in the freedom of the old woods, and to grow young again lying upon the brookside, and counting the white clouds that sail along the sky, softly and tranquilly, even as holy memories go stealing over the vault of life.—Donald G. Mitchell.

QUALITY BETTER THAN QUANTITY.

Not merely growing like a tree
In bulk doth make man better be
Or standing long an oak three hundred years,
To fall a log at last, dry, bald and sear,
A lily of a day is fairer far in May.
Although it fall and die that night,
It was the plant and flower of light;
In small proportions we just beauties see
And in short measure life may perfect be.
—[Ben Jonson.

THE TASTE FOR TREES.

There is something noble, simple, and pure in a taste for trees. It argues, I think, a sweet and generous nature to have this strong relish for beauties of vegetation, and this friendship for the hardy and glorious sons of the forest. There is a grandeur of thought connected with this part of rural economy. It is worthy of liberal and freeborn and aspiring men. He who plants an oak looks forward to future ages, and plants for posterity. Nothing can be less selfish than this. He can not expect to sit in its shade nor enjoy its shelter, but he exults in the idea that the acorn which he has buried in the earth shall grow up into a lofty pile and shall keep on flourishing and increasing and benefiting mankind long after he shall have ceased to tread his paternal fields.—Washington Irving.

ACCORDANCE OF NATURE.

For Nature beats in perfect tune,
And rounds with rhyme her every rune,
Whether she work in land or sea,
Or hide underground her alchemy.
Thou cans't not wave thy staff in air,
Or dip thy paddle in the lake,
But it carves the bow of beauty there,
And the ripples in rhymes the oar forsake.
The wood is wiser far than thou;
The wood and wave each other know.
Not unrelated, unaffied,
But to each thought and thing allied,
Is perfect Nature's every part,
Rooted in the mighty Heart.
—[Emerson.

DOING GOOD.

When we plant a tree we are doing what we can to make our planet a more wholesome and happier dwelling place for those who come after us, if not for ourselves.—O. W. Holmes.

NOBILITY.

True worth is in *being*, not *seeming*,
In doing each day that goes by
Some little good—not in the dreaming
Of great things to do by and by.
—[Alice Cary.

THE BANK OF CONTENTMENT.

While I live, I trust I shall have my trees, my peaceful idyllic landscape, my free country life, at least half the year; and while I possess so much, * * * I shall own 100,000 shares in the Bank of Contentment.—Bayard Taylor.

TREES COMPOSITE BEINGS.

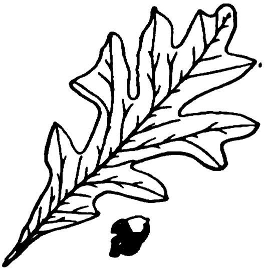
A tree is a composite being; a kind of community by itself. The leaves and limbs are all the time striving with each other to see which shall have the most room and the most sunshine. Each strives for all he can get. While some perish in the attempt, or meet with only very indifferent success, the strongest of the strongest buds survive. Each leaf helps to sustain the limb which carries it, and each limb furnishes some nourishment to the common trunk for the common welfare. The tax is always adjusted according to the ability of each to contribute. As the limbs of a tree are constantly striving for the mastery, so each bush and tree in grove or forest is striving with others for the mastery. The weakest succumb to the strongest; some perish early; some lead a feeble existence for many years, while even the strongest are more or less injured. With plenty of room, the trunk will be short, the branches many and widespread; where crowded, the lower limbs perish for want of light. Dead limbs fall to the ground to protect and enrich it for nourishing the surviving limbs and the trunk. The scars heal over, more limbs perish as new ones creep upward, and thus we find tall, clean trunks in a dense forest.—Anon.

TEACHING.

One impulse from a vernal wood
May teach you more of man,
Of moral evil and of good,
Than all the sages can.
—[Wordsworth.

OBSERVATION.

It is better to know the habits of one plant than the names of a thousand; and wiser to be happily familiar with those that grow in the nearest field than arduously cognizant of all that plume the isles of the Pacific or illumine the Mountains of the Moon.—Ruskin.



LEAF-TONGUES OF THE FOREST.

The leaf-tongues of the forest, the flower-lips of the sod,
The happy birds that hymn their rapture in the ear of God,
The summer wind that bringeth music over land and sea,
Have each a voice that singeth this sweet song of songs to me;
"This world is full of beauty, like other worlds above
And if we did our duty, it might be full of love."
—[Gerald Massey.

LESSONS OF THE TREES.

I shall speak of trees as we see them, love them, adore them in the fields where they are alive, holding their green sunshades over our heads, talking to us with their hundred thousand whispering tongues, looking down on us with that sweet meekness which belongs to huge but limited organism—which one sees most in the patient posture, the outstretched arms, and the heavy drooping robes of these vast beings, endowed with life, but not with soul—which outgrow us and outlive us, but stand helpless, poor things, while nature dresses and undresses them.—Holmes.

IMPORTANCE OF FORESTS.

Keeping up a fit proportion of forests to arable land is the prime condition of human health. If the trees go, men must decay. Whosoever works for the forests works for the happiness and permanence of our civilization. A tree may be an obstruction, but it is never useless. Now is the time to work if we are to be blessed and not cursed by the people of the twentieth and twenty-first centuries. The nation that neglects its forests is surely destined to ruin.—Hon. Elizur Wright.

NATURE'S BOOK.

* * * * *

And Nature, the old nurse, took
The child upon her knee,
Saying: "Here is a storybook
Thy Father has written for thee."

"Come, wander with me," she said,
"Into regions yet untrod;
And read what is still unread
In the manuscripts of God."

And he wandered away and away
With Nature, the dear old nurse,
Who sang to him night and day
The rhymes of the universe.

And whenever the way seemed long,
Or his heart began to fail,
She would sing a more wonderful song,
Or tell a more marvelous tale.

* * * * *

—Longfellow—"The Fiftieth Birthday of Agassiz."

BEST GIFTS.

Gifts that grow are best;
Hands that bless are blest;
Plant: Life does the rest!
Heaven and earth help him who plants a tree,
And his work its own reward shall be.

—[Lucy Larcom.

SYMPATHY WITH TREES.

I care not how men trace their ancestry,
To ape or Adam; let them please their whim;
But I in June am midway to believe
A tree among my far progenitors,
Such sympathy is mine with all the race,
Such mutual recognition vaguely sweet
There is between us.

—[Lowell.

BRYANT, THE POET OF TREES.

"It is pleasant," as Mr. George W. Curtis has said, "to remember, on Arbor Day, that Bryant, our oldest American poet and the father of our American literature, is especially the poet of trees. He grew up among the solitary hills of western Massachusetts, where the woods were his nursery and the trees his earliest comrades. The solemnity of the forest breathes through all his verse, and he had always, even in the city, a grave, rustic air, as of a man who heard the babbling brooks and to whom the trees told their secrets."

His "Forest Hymn" is familiar to many, but it can not be too familiar. It would be well if teachers would encourage their pupils to commit the whole, or portions of it at least, to memory. Let it be made a reading lesson, but, in making it such, let pains be taken to point out its felicities of expression, its beautiful moral tone and lofty sentiment, and its wise counsels for life and conduct. Nothing could be more appropriate, especially for the indoor portion of the Arbor Day exercises, than to have this poem, or portions of it, read by some pupil in full sympathy with its spirit, or by some class in concert.

EXTRACT FROM BRYANT'S "FOREST HYMN."

Father, Thy hand
Hath reared these venerable columns; Thou
Didst weave this verdant roof. Thou didst look down
Upon the naked earth, and forthwith rose
All these fair ranks of trees. They, in Thy sun,
Budded, and shook their green leaves in Thy breeze,
And shot toward heaven. The century-living crow
Whose birth was in their tops, grew old and died
Among their branches, till, at last, they stood,
As they now stand, massy, and tall, and dark,
Fit shrine for humble worshiper to hold
Communion with his Maker. These dim vaults,
These winding aisles, of human pomp or pride
Report not. No fantastic carvings show
The boast of our vain race to change the form
Of Thy fair works. But Thou art here—Thou fill'st
The solitude. Thou art in the soft winds
That run along the summit of these trees
In music; Thou art in the cooler breath
That from the inmost darkness of the place
Comes, scarcely felt; the barky trunks, the ground,
The fresh, moist ground, are all instinct with Thee.

Here is continual worship. Nature, here,
In the tranquillity that Thou dost love,
Enjoys Thy presence. Noiselessly around,
From perch to perch, the solitary bird
Passes; and yon clear spring, that, 'midst its herbs,
Wells softly forth, and, wandering, steeps the roots
Of half the mighty forest, tells no tale
Of all the good it does. Thou hast not left
Thyself without a witness, in these shades,
Of Thy perfections. Grandeur, strength and grace
Are here to speak of Thee. This mighty oak—
By whose immovable stem I stand and seem
Almost annihilated—not a prince
In all that proud old world beyond the deep,
E'er wore his crown as loftily as he
Wears the green coronal of leaves with which
Thy hand has graced him. Nestled at his root
Is beauty such as blooms not in the glare
Of the broad sun. That delicate forest flower,
With scented breath and look so like a smile,
Seems, as it issues from the shapeless mold,
An emanation of the indwelling Life,
A visible token of the upholding Love,
That are the soul of this wide universe.

* * * * *

Be it ours to meditate
In these calm shades, Thy milder majesty,
And to the beautiful order of Thy works
Learn to conform the order of our lives.

—[Bryant.

BLESSING FOR THE TREE PLANTER.

O painter of the fruits and flowers!
We thank Thee for thy wise design
Whereby these human hands of ours
In nature's garden work with Thine.

* * * * *

Give fools their gold and knaves their power;
Let fortune's bubbles rise and fall;
Who sows a field or trains a flower
Or plants a tree is more than all.

For he who blesses most is blest;
And God and man shall own his worth
Who toils to leave as his bequest
An added beauty to the earth.

And, soon or late, to all who sow,
The time of harvest shall be given;
The flower shall bloom, the fruit shall grow,
If not on earth, at last in heaven.

—[Whittier.

GREAT CRYPTOMERIA AVENUE OF JAPAN.

The people of a certain locality in Japan, it is said, love to tell this story of what is perhaps the most beautiful road in the Japanese Empire. When the great general and lawgiver Iyecsasu died, his former tributary princes vied with one another in rich mortuary gifts to perpetuate his memory. One daimio, loving and loyal, instead of the customary gift of rare bronze or wrought stone to honor his dead lord, gave from his forest land thousands of cryptomeria trees, which he wisely knew would be an ever-growing delight for generations in a densely populated region.

These young trees, which were then but 18 inches or more in height, he planted at equal distances along the two roads leading to Nikko, where the body of the dead prince was interred. Two hundred years have passed, and the trees, so small when planted, are giants now, whose branches interlock across the wide roadway, presenting to the traveler in either direction a vista of green as far as the eye can reach. Extending for 30 miles in one direction, and for 20 miles in another, these rows of noble trees meet 7 miles from the temple where lie the ashes of the honored dead, and for this last 7 miles a double row of trees is found on each side of the roadway. In describing this unique and very beautiful tribute of respect and affection, a recent traveler says:

"Many who visit Nikko may forget the loveliness of the mountain scenery, the waterfalls and rushing streams, the carving and gilding of the temples, the soft, low tone of the bells, the odor of incense, and the chanting of priests, but few will forget their 20 miles' ride beneath the over-arching branches of the stately trees. What more beautiful memorial could be suggested than this, which benefits rich and poor, prince and coolie, alike, while mere bronze lanterns and costly but dead memorial stones are of no service except as reminders of a bygone age?"

These trees have been growing for two centuries; a half dozen generations have enjoyed their coolness, their beauty, refreshing to tired eyes and weary limbs, and they will be the delight of generations to come.—Prof. J. P. McCaskey.

AN APRIL DAY.

When the warm sun, that brings
Seedtime and harvest, has returned again,
'Tis sweet to visit the still wood, where springs
The first flower of the plain.

* * * * *

From the earth's loosened mold
The sapling draws its sustenance, and thrives;
Though stricken to the heart with winter's cold,
The drooping tree revives.

The softly warbled song
Comes from the pleasant woods, and colored wings
Glance quick in the bright sun, that moves along
The forest openings.

* * * * *

Sweet April! many a thought
Is wedded unto thee, as hearts are wed;
Nor shall they fail, till, to its autumn brought,
Life's golden fruit is shed.

—[Longfellow.

THE WOODS AND THE COURT.

In the forest of Arden, Shakespeare makes the banished duke say to his companions:

"Now, my co-mates and brothers in exile,
Hath not old custom made this life more sweet
Than that of painted pomp? Are not these woods
More free from peril than the envious court?
Here feel we but the penalty of Adam,
The seasons' difference; as the icy fang
And churlish chiding of the winter's wind,
Which, when it bites and blows upon my body,
Even till I shrink with cold, I smile and say:
'This is no flattery; these are counsellors
That feelingly persuade me what I am.'
Sweet are the uses of adversity; * * *

* * * * *

And this our life, exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in everything."

—[As You Like It, act 2, scene 1.

THE SPIRIT OF POETRY.

There is a quiet spirit in these woods,
That dwells where'er the gentle south wind blows;
Where underneath the white-thorn, in the glade,
The wild flowers bloom, or, kissing the soft air,
The leaves above their sunny palms outspread.
With what a tender and impassioned voice
It fills the nice and delicate ear of thought,
When the fast ushering star of morning comes
O'erriding the gray hills with golden scarf;
Or when the cowled and dusky-sandaled Eve,
In mourning weeds, from out the western gate,
Departs with silent pace! That spirit moves
In the green valley, where the silver brook,
From its full laver, pours the white cascade;
And, babbling low amid the tangled woods,
Slips down through moss-grown stones with endless laughter.
And frequent, on the everlasting hills.
Its feet go forth, when it doth wrap itself
In all the dark embroidery of the storm,
And shouts the stern, strong wind. And here, amid
The silent majesty of these deep woods,
Its presence shall uplift thy thoughts from earth,
As to the sunshine and the pure, bright air,
Their tops the green trees lift. * * *

—[Longfellow.

SELECTIONS FOR RECITATIONS.

THE PURPOSE OF ARBOR DAY.

To avert treelessness; to improve the climatic conditions; for the sanitation and embellishment of home environments; for the love of the beautiful and useful combined in the music and majesty of a tree, as fancy and truth unite in an epic poem, Arbor Day was created. It has grown with the vigor and beneficence of a grand truth or a great tree.—J. Sterling Morton.

FOREST HYMN.

The groves were God's first temples. Ere man learned
To hew the shaft, and lay the architrave,
And spread the roof above them—ere he framed
The lofty vault, to gather and roll back
The sound of anthems; in the darkling wood,
Amidst the cool and silence, he knelt down,
And offered to the Mightiest solemn thanks
And supplication. For his simple heart
Might not resist the sacred influences
Which, from the stilly twilight of the place,
And from the gray old trunks that high in heaven
Mingled their mossy boughs, and from the sound
Of the invisible breath that swayed at once
All their green tops, stole over him, and bowed
His spirit with the thought of boundless power
And inaccessible majesty. Ah, why
Should we, in the world's riper years, neglect
God's ancient sanctuaries, and adore
Only among the crowd, and under roofs
That our frail hands have raised? Let me, at least,
Here, in the shadow of this aged wood,
Offer one hymn—thrice happy if it find
Acceptance in His ear.

* * * * *

—[Bryant.

LEAVES.

The leaves of the herbage at our feet take all kinds of strange shapes, as if to invite us to examine them. Star-shaped, heart-shaped, spear-shaped, arrow-shaped, fretted, fringed, cleft, furrowed, serrated, sinuated, in whorls, in tufts, in spires, in wreaths, endlessly expressive, deceptive, fantastic, never the same from footstalk to blossom, they seem perpetually to tempt our watchfulness and take delight in outstripping our wonder.—Ruskin.

INFLUENCE OF NATURE.

Therefore am I still
A lover of the meadows and the woods
And mountains, and of all that we behold
From this green earth; of all the mighty world
Of eye and ear, both what they half create
And what perceive; well pleased to recognize
In nature, and the language of the sense,
The anchor of my purest thoughts, the nurse,
The guide, the guardian of my heart, and soul,
Of all my moral being.
—[Wordsworth.

THE FOREST A HERITAGE.

I regard the forest as an heritage, given to us by nature, not for spoil or to devastate, but to be wisely used, reverently honored, and carefully maintained. I regard the forest as a gift intrusted to us only for transient care during a short space of time, to be surrendered to posterity again as unimpaired property, with increased riches and augmented blessings, to pass as a sacred patrimony from generation to generation.—Baron Ferdinand von Mueller.

STEADFASTNESS.

A little of thy steadfastness,
Rounded with leafy gracefulness,
Old oak, give me—
That the world's blasts may round me blow,
And I yield gently to and fro,
While my stout-hearted trunk below
And firm-set roots unshaken be.
—[Lowell.

THE WASHINGTON ELM.

This tree still stands at Cambridge, Mass. It is on Garden street, a short distance from the colleges, and is a large, well-preserved tree. An iron fence is built around it, and on a stone in front is the following inscription: "Under this tree George Washington took command of the American Army, July 3, 1775."

Beneath our consecrated elm
A century ago he stood,
Famed vaguely for that old fight in the wood
Whose red surge sought, but could not overwhelm
The life foredoomed to wield our rough-hewn helm:—

* * * * *

Firmly erect, he towered above them all,
The incarnate discipline that was to free
With iron curb that armed democracy.
—[Lowell—"Under the Old Elm."

WEALTH IN WOOD.

The true basis of national wealth is not gold, but wood. Forest destruction is the sin that has caused us to lose our earthly paradise. War, pestilence, storms, fanaticism, and intemperance, together with all other mistakes and misfortunes, have not caused half as much permanent damage as that fatal crime against the fertility of our Mother Earth.—Felix L. Oswald.

SUBJECTS FOR DECLAMATION

Character of Washington	Thomas Jefferson
Eulogium on Washington	Daniel Webster
Antiquity of Freedom	Bryant
Paul Revere's Ride	Longfellow
Story of Bunker Hill Battle	O. W. Holmes
The American Flag	J. Rodman Drake
Centennial Hymn	Whittier
Tribute to Abraham Lincoln	J. R. Lowell
Sheridan's Ride	Read
Song of Marion's Men	Bryant
Centennial Song	Bayard Taylor
America	S. F. Smith
The Flag of the Union	George P. Morris
Union and Liberty	O. W. Holmes

Other selections for recitation or declamation, a few out of the many, are the following:

A June Day	Lowell: Sir Launfal
Planting of the Apple Tree	Bryant
The Last Leaf	Holmes
Under the Greenwood Tree	Shakespeare
Among the Trees	Bryant
The Spirit of Poetry	Longfellow
Plant a Tree	Lucy Larcom
The Prairies	Bryant
Popular Poplar Tree	Blanch W. Howard
Woodman, Spare that Tree	Morris
The Ivy Green	Dickens
The Oak	Lowell
The Pine Tree	Emerson
Fair Tree	Lady Winchelsea
Hiawatha, extracts from	Longfellow
Landing of the Pilgrims	Mrs. Hemans
Love of Nature	Wordsworth
May Queen	Tennyson
Discourse on Trees	Beecher

TOPICS FOR ARBOR DAY ESSAYS.

Celebrated trees.
Short history of Arbor Day.
What Arbor Day is for.
How to plant a tree.
Best trees to plant.
The most useful tree.
Trees and their relation to birds.
Trees and their relation to fishes.
Varieties of trees on our farm.
Schoolhouses: What they are and what they should be.
Schoolgrounds: How to improve them.
What the leaves do.
Best trees to plant on the roadside.
Planting nut-bearing trees: Encouragement for it.
Best trees and shrubs for ornamental planting.
What to do with signs that are nailed to trees and fences and painted on the rocks.
How to do away with rubbish on the roadsides.
Advantages of good sidewalks.
Roads and walks, and how to make them.
How to make Arbor Day most useful.
Teaching of botany and horticulture in schools.

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OCT 29 1897

U. S. DEPARTMENT OF AGRICULTURE.

PROCEEDINGS OF THE NATIONAL CONVENTION

FOR THE

SUPPRESSION OF INSECT PESTS AND PLANT DISEASES BY LEGISLATION,

HELD AT WASHINGTON, D. C., MARCH 5 AND 6, 1897.

EDITED BY B. T. GALLOWAY.

WASHINGTON:
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LETTER OF SUBMITTAL.

DOVER, DEL., *July 1, 1897.*

SIR: I have the honor to submit herewith the report of the proceedings of the National Convention for the Suppression of Insect Pests and Plant Diseases by Legislation, held in the city of Washington, March 5 and 6, 1897. In accordance with a request made by the convention, it was agreed that your Department would publish the proceedings, providing one of its officers edit them. This work was duly performed, under the direction of the special agent in charge of scientific investigations, by Mr. B. T. Galloway, Chief of the Division of Vegetable Physiology and Pathology, and with the assistance of the divisions of the Department having charge of the lines of work touched upon. The conditions of its publication by the Department having thus, I believe, been fully and satisfactorily complied with, I have the honor to invite the publication of the report as agreed, and at the same time on behalf of the convention to tender to you its thanks for this courtesy.

Respectfully,

WESLEY WEBB,
Secretary of the Convention.

Hon. JAMES WILSON,
Secretary of Agriculture.

In accordance with the agreement as stated above, the publication of these proceedings by the Department of Agriculture is hereby authorized.

JAMES WILSON,
Secretary.

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PROCEEDINGS OF THE NATIONAL CONVENTION FOR THE SUPPRESSION OF INSECT PESTS AND PLANT DISEASES BY LEGISLATION.

MORNING SESSION, FRIDAY, MARCH 5, 1897.

The delegates present met in the parlors of the Ebbitt House at 10 a. m. March 5. Mr. E. H. Cushman, president of the Ohio State Horticultural Society, called the convention to order and then read the following printed notice, addressed to horticultural and agricultural societies, State experiment stations, and kindred institutions and organizations:

CALL FOR THE CONVENTION.

A call for a national convention to consider and recommend the most appropriate Federal and State legislation for preventing the introduction or diffusion of noxious insects and fungi in the United States.

At a regular meeting of the Ohio State Horticultural Society in February, 1896, the following resolution was adopted by a unanimous vote:

Resolved, That the secretary be requested to correspond with the secretaries of all the other State horticultural societies and request them to bring before their societies the question as to the propriety of the appointment of delegates to a national convention for the purpose of considering means of preventing the spread of noxious insects and fungous diseases by appropriate State and Federal legislation.

Several efforts have been made and are being put forth in various parts of the United States indicating the desirability of some united effort being made in this direction, and the rapidity with which these pests of our orchards and fields are increasing renders prompt and efficient legislation looking toward their suppression or control most imperative and absolutely essential to success in horticultural and agricultural pursuits. The number of favorable replies received to the circulars sent out by the secretary justifies the society in calling a national convention.

In view of the foregoing facts the Ohio State Horticultural Society invites all horticultural and agricultural societies, experiment stations, and kindred organizations to send delegates to meet in convention at the Ebbitt House, in Washington, D. C., at 10 a. m. March 5, 1897, to consider the best measures to be taken in securing such national legislation and supplementary uniform State legislation as may be necessary to prevent the dissemination of noxious insects and fungi and prevent their introduction into the United States from other countries.

All persons interested are invited to attend.

E. H. CUSHMAN, *President.*
W. W. FARNSWORTH, *Secretary.*

After the reading of the notice the chair appointed the following committees:

COMMITTEE ON CREDENTIALS.

E. S. Goff, Wisconsin.
F. M. Webster, Ohio.
M. J. Daniels, California.

COMMITTEE ON PERMANENT ORGANIZATION.

W. B. Alwood, Virginia.
R. S. Emory, Maryland.
E. M. Wardell, California.

REPORT OF COMMITTEE ON CREDENTIALS.

The committee on credentials reported the following delegates present and entitled to seats in the convention:

List of delegates.

Alwood, W. B., Va. Exp. Sta. and State Hort. Soc., Blacksburg, Va.
Bachelder, N. J., Secretary State Board of Agr., Concord, N. H.
Baker, J. W., Tenn. Dept. of Agr., Nashville, Tenn.
Barry, W. C., Pres. Western N. Y. Hort. Soc. and Pres. Eastern Nurserymen's Association, Rochester, N. Y.
Beach, S. A., N. Y. State Exp. Sta., Geneva, N. Y.
Bissell, E. H., Richmond, Va.
Brigham, J. H., Master National Grange, Delta, Ohio.
Brown, J. F., Vice Pres. State Board of Agr., North Stonington, Conn.
Chamberlain, S. E., Pres. Catoctin Farmers' Club, Loudon Co., Va.
Cushman, E. H., Pres. Ohio Hort. Soc., Euclid, Ohio.
Daniels, M. J., State Board of Hort., Riverside, Cal.
Denise, D. Demarest, Pres. State Board of Agr., Freehold, N. J.
Derby, Samuel H., Peninsula Hort. Soc., Woodside, Del.
Emory, R. S., Peninsula Hort. Soc., Chestertown, Md.
Evans, Walter H., Office of Experiment Stations, U. S. Dept. of Agr., Washington, D. C.
Farnsworth, W. W., Secretary State Hort. Soc., Waterville, Ohio.
Galloway, B. T., Pathologist U. S. Dept. of Agr., Washington, D. C.
Garman, H., Ky. Agr. Exp. Sta. and State Hort. Soc., Lexington, Ky.
Goff, E. S., Wis. Exp. Sta. and State Hort. Soc., Madison, Wis.
Gulick, Robt., Farmers' Alliance, Linkwood, Md.
Hale, J. H., Pres. Conn. Pomological Soc., South Glastonbury, Conn.
Heiges, S. B., Pomologist U. S. Dept. of Agr. and Pres. Pa. Hort. Soc., Washington, D. C.
Henry, E. S., Board of Agr., Conn.
Hobbs, C. M., Ind. Hort. Soc., Bridgeport, Ind.
Hooker, C. M., Western N. Y. Hort. Soc., Rochester, N. Y.
Howard, L. O., Entomologist U. S. Dept. of Agr., Washington, D. C.
Johnson, W. G., State Entomologist of Maryland, College Park, Md.
King, W. M., Va. State Grange, Glencarlyn, Va.
Lowe, V. H., Entomologist State Exp. Sta., Geneva, N. Y.
Lugger, Otto, Minn. Agr. Exp. Sta. and State Hort. Soc., St. Anthony Park, Minn.
Lupton, S. L., Fruit Growers' Association, Winchester, Va.
McCarthy, Gerald, Secretary N. C. Hort. Soc., Raleigh, N. C.

McLachlan, James, Board of Hort. Com., Los Angeles, Cal.
Miller, W. W., Secretary State Board of Agr., Columbus, Ohio.
Powell, G. Harold, Del. Exp. Sta., Newark, Del.
Sessions, Wm. R., Secretary State Board of Agr., Boston, Mass.
Slingerland, M. V., Cornell University Agr. Exp. Sta., Ithaca, N. Y.
Snow, H. K., Tustin Fruit Growers' Association, Tustin, Cal.
Taylor, Wm. A., Mich. Hort. Soc., Washington, D. C.
Van Deman, H. E., Pres. Peninsula Hort. Soc., Parksley, Va.
Van Lindley, J., Pres. N. C. Hort. Soc., Pomona, N. C.
Waite, M. B., Div. Veg. Phys. and Path., U. S. Dept. of Agr., Washington, D. C.
Wardell, E. M., State Board of Hort., Los Angeles, Cal.
Webb, Wesley, Del. Farmers' Institute and Secretary Peninsula Hort. Soc., Dover, Del.
Webber, H. J., Div. Veg. Phys. and Path., U. S. Dept. of Agr., Subtropical Laboratory, Eustis, Fla.
Webster, F. M., Entomologist Ohio Exp. Sta., Wooster, Ohio.

The report of the committee on credentials was adopted

REPORT OF COMMITTEE ON PERMANENT ORGANIZATION.

The report of the committee on permanent organization was then made and adopted, as follows:

Officers.

Chairman, E. H. Cushman, Ohio.
Vice chairman, J. H. Hale, Connecticut.
Secretaries, { Wesley Webb, Delaware.
M. J. Daniels, California.
Sergeant-at-arms, Robert Gulick, Maryland.

Order of business.

(1) Appointment of committees.
(2) Reading of papers.
(3) Discussion of papers.
(4) Reports of committees.

Rules.

(1) That all resolutions or proposed laws be referred to the appropriate committee without debate.

(2) That there be a committee of five on resolutions and a committee of ten on legislation.

The committees were then named, as follows:

COMMITTEE ON RESOLUTIONS.

W. C. Barry, New York.
N. J. Bachelder, New Hampshire.
C. M. Hobbs, Indiana.
E. M. Wardell, California.
J. H. Hale, Connecticut.

COMMITTEE ON LEGISLATION.

W. B. Alwood, Virginia.
C. M. Hooker, New York.
J. Van Lindley, North Carolina.
E. M. Wardell, California.
N. J. Bachelder, New Hampshire.
D. Demarest Denise, New Jersey.
E. S. Henry, Connecticut.
C. M. Hobbs, Indiana.
E. S. Goff, Wisconsin.
F. M. Webster, Ohio.

The presiding officer next called for the reading of papers. The first, by Mr. B. T. Galloway, Chief of the Division of Vegetable Physiology and Pathology, United States Department of Agriculture, was as follows:

PLANT DISEASES AND THE POSSIBILITY OF LESSENING THEIR SPREAD BY LEGISLATION.

It needs little argument to prove that the enemies of cultivated plants are steadily increasing, and I think it can be easily shown that they will continue to increase so long as the conditions, for which we are in large part responsible, remain as they are at present. I do not by any means regard this as a calamity. On the contrary, I look upon the fact that our insect and fungous foes are increasing as direct proof that we are progressing, for, as Professor Bailey has said, "Our enemies increase because cultivation induces change of habits in wild organisms; because it presents an ever-increasing variety of food, or host plants; because the food supply is large and in more or less continuous areas; and finally, because the natural equilibrium, or tension, is destroyed." It follows, therefore, that the more we put forth our energies to improve our native plants or to change their habits; the more we endeavor to increase the variety and number of our cultivated vines, trees, and shrubs; the more we extend our orchards, our vineyards, and our fields, just so much more do we disturb the equilibrium in nature, and just so much more must we expect to burden ourselves with the work of maintaining this unstable condition by more or less artificial means. Where an insect or fungus had one chance a hundred years ago to wax strong and spread, it has now a thousand chances, for unbroken orchards and vineyards and millions of nursery trees cover the country where then only wild plants grew.

It is but natural, then, that man, seeing the onward march of his enemies, should look about him and wonder how it will all end, and how he, as an individual, is to obtain relief. In many cases he has found a way of doing this by adopting certain more or less empirical methods. Again, with a fuller appreciation of the fundamental principles underlying plant growth, he has learned, partly by intuition, to keep his plants in health, and when he has reached this stage he stands far in advance of his neighbor who waits until his plants are diseased and then begins to look about for a spraying apparatus. It frequently follows, however, that with all his efforts he is not able to help himself, and then, in accordance with what he considers his privilege, he appeals to the State, believing, or at least hoping, that by legislation he can even up matters to the advantage of himself and the detriment of his foes.

In answer to such appeals a number of State laws have been enacted. Some of these have been partly satisfactory, but none have served fully the object for which they were intended. This is nothing more than might have been expected, seeing the widely divergent interests of the different States, the lack of anything like cooperation, and the fact that public sentiment in many cases is indifferent or unfavorable toward such laws, thus making proper enforcement impracticable.

I take it that one of the principal objects of this convention is to consider these matters, and, after hearing as many sides to the question as possible, to take some action which will at least lead to a better understanding of what can or can not be done. Let us, then, consider for a moment the nature of some of the more common and destructive plant diseases, for it is only in the possession of such knowledge that we can intelligently discuss the problems relating to legislation.

So far as we are at present concerned, the diseases of plants may be divided into two principal groups, namely, those due to organized beings, such as insects and fungi, and those in which organisms take no direct part, as, for example, improper conditions of the soil, such as too much or too little water; unfavorable atmospheric influences; and the presence of poisonous substances in the soil, air, etc. In this paper we are not particularly concerned with the insect pests, as they will doubtless receive full consideration from others present.

No hard and fast lines can be drawn between the diseases due to fungi and those brought on by unfavorable environment. Many, if not all, fungous diseases are greatly influenced by environment—just as much so as the hosts themselves. In many cases we find that a plant grown with success in a certain region succumbs to disease when transferred to another where the conditions are such as to make it necessary for the plant to adapt itself to the new requirements. During the process of adaptation fungi may find opportunity, and the host once infected it may be only a question of time when it is forced to succumb. In such cases it would be obviously unjust to hold the man who grew the trees responsible. It was not his fault that the conditions under which the purchaser planted the trees were different from those nature furnished him to grow them.

A case in point will more clearly illustrate this matter. Suppose I purchase a thousand apple trees from a nurseryman and plant them in what to all intents and purposes is a suitable piece of ground. This ground may have recently been cleared, and in addition to the remains of roots of certain forest trees, the soil may be slightly wetter than that of the nursery. The decaying roots of the forest trees in the soil may contain the mycelium of a fungus, which under ordinary conditions would not attack a healthy apple root. Owing to the slight additional wetness, however, and the consequent lack of aeration, some of the apple roots in time will be asphyxiated, or will be injured in other ways, the details of which need not be given here. While the roots may be only slightly injured, they nevertheless in this condition become readily susceptible to the attacks of the fungus already in the soil, and the disease once started all the roots may eventually be killed, and the tree will die. Hundreds of trees may be killed in this or some similar way, and yet from the very nature of the trouble, the delicate questions involved, and the complications that may arise, no man could positively assert where the blame rests.

We are by no means holding the nurseryman up as a paragon of honesty, but we do wish to give him fair play, for he is unquestionably often blamed for things for which he is not in the least responsible.

Again, there is a vast number of fungous diseases which are almost as universally distributed as the host plants themselves. They occur not only on the cultivated forms. but in the woods and wild places, whence they doubtless originally came. Such is black rot, downy mildew, and powdery mildew of the grape; apple scab and rust; and a host of other maladies. It would be manifestly as impossible to control such enemies by legislation as it would be to control the dust of the air or the wind that wafts it from place to place. Furthermore, it must be remembered that a great many—in fact the majority—of the most destructive diseases which affect nursery stock are of such a nature that no reliable system of inspection can be carried out. Such being the case, we are free to say that in most cases the certificates that are given declaring trees to be free from disease are little better than worthless.

Ten thousand peach trees may be shipped into a State, and so far as any one can determine they may be perfectly healthy. Notwithstanding this, 50 per cent or more of the trees may be infected with yellows, and what is more, the malady may not develop for a year after the trees have been planted. What is true of peach yellows is true of many other diseases, particularly those where the leaves alone are the parts attacked.

Without further argument, therefore, it may be said that any general laws looking toward the control of nursery stock are likely to prove impracticable, first, because the nature of the diseases is such as to render proper inspection exceedingly difficult, if not impossible, and second, no one with any regard for scientific truth or accuracy would care to risk his reputation in giving an opinion where so many complications are involved.

Of course there may be special cases where laws would be an advantage. Take, for example, pear blight in the nursery. Young trees may become infected and the disease remain dormant in them until they are set in the orchard. Inspection here might be of benefit, but it is questionable whether legislation would facilitate matters in the least. Probably not one nurseryman in a thousand would refuse to take the proper precautions for eradicating blight if the way were pointed out to him. It would be a matter of business for him to do so; and this introduces the question as to how far many of the problems involved in the matter under discussion could be controlled by proper organization among the experiment station workers and others who might be easily induced to cooperate with them. I can see no reason why a properly organized force of this kind, acting throughout in a uniform manner, would not accomplish much good, not only in educating nurserymen and others in the lines of work that should be followed where emergencies may arise, but also by taking such legitimate and proper action, where the exigencies demand, as to make it to the interest of all owners of nursery stock to be able to truthfully say that they have put forth every effort to have every tree sent out absolutely free from dangerous insect, fungous, or other pests.

So far our discussion has dealt mainly with the nurseryman. It must be remembered, however, that there are other phases of the problem. The fruit grower himself is to be considered and may often prove an important factor to deal with. The energetic, successful man, who puts forth every effort to keep his trees free from the various foes which beset them, may often have his best efforts rendered more or less futile by the fact that his neighbor's trees harbor all sorts of insects and fungi. It is a delicate matter to say what shall be done in such a case. The man whose trees are infested may not be shiftless. He may be the victim of natural laws, for which he is in no way responsible, or he may, for personal or other reasons, not be able to care for his trees as should be done. To hold the law over this man and say that he should spray his trees or destroy them, or else pay a fine or go to jail, would be manifestly unjust. Public sentiment would support him, and therefore the law, should it exist, could not be enforced.

Finally, there is a question of imported pests to consider. What has been said of the impracticability of inspection laws will also apply here. It may sometimes happen, however, that a dangerous pest is imported, and although established in one or more places, might be quickly and easily eradicated by prompt and intelligent action supported by proper legislation. Even here, however, the futility of State laws can be seen, for the pest may be established at isolated spots in three or more States, and while the laws of one State may make it impossible to exterminate the enemy, those of the next may be wholly powerless to cope with it. In such cases, and also where any pest hitherto confined to comparatively limited areas shows an alarming tendency to spread, proper Federal legislation might serve a useful purpose. What would constitute proper Federal legislation is not within our province to say, as the complications involved are far too numerous to be considered here. Suffice it to say, however, that the precedent for such legislation seems to have been established in creating the Bureau of Animal Industry of the United

States Department of Agriculture. By this act the head of the Department is given the power to prepare such rules and regulations as might be deemed necessary for the speedy and effectual suppression of the diseases of domestic animals. Necessary rules and regulations are to be certified to the executive authority of each State and Territory, and said authorities are to be asked to cooperate in the enforcement and execution of the act. This removes all difficulties that may arise between Federal and State authorities, and gives the head of the Department power to act whenever an emergency arises. The rules provide for the necessary means of bringing to the attention of the Department any contagious or communicable disease, the appointment of inspectors, the quarantining of infected localities, destruction of the diseased animals, and compensation therefor whenever the latter is recommended by a board of appraisers appointed by virtue of the act in question. Whether such a general law or a similar one could be made operative in the case of insects and fungi is a question. Public sentiment is not as yet very far advanced in such matters, and public sentiment is what makes a law operative. In any event, it seems to me that a law, no matter how drawn, would prove useful only in certain special emergencies. The greater portion of our plant diseases and insect pests can not be reached by legislation. They are governed by natural laws, and it is to these that we should turn our attention. Let us strive, therefore, to obtain more light on nature's fundamental truths, for one such truth well understood may prove of more lasting benefit than legislation without end.

The next paper called for was by Mr. L. O. Howard, Entomologist of the United States Department of Agriculture. The following is an abstract of the paper made by the author, who has reserved the complete article for publication elsewhere:

THE DESIRABILITY OF AN INSPECTION SYSTEM AGAINST FOREIGN INSECTS.

The speaker called attention to the fact that fully one-half the principal injurious insects of the United States are of foreign origin, and have at one time or another been accidentally imported into this country, where, in the majority of cases, they have flourished to a degree unknown in their original home. This statement was supported by instancing many important injurious species. It was shown that aside from a large number of insect enemies of field crops, most of the granary pests, most of the household pests, and most of the greenhouse pests belong to the class of imported species. The countries of origin were briefly discussed, and it was shown that while Europe is the home of the majority of the imported species, the recent development of commercial intercourse with eastern Asiatic countries, especially China and Japan, in connection with the enormous development of agriculture and horticulture on the Pacific Coast, is now resulting in the arrival at the port of San Francisco of many new insect enemies of vegetation. It was further shown that there is much less danger of importations of this character from the Southern Hemisphere, since such an importation would involve a change of climate. An insect shipped from Chile in midsummer, for example, would arrive in this country in midwinter, and such a radical change, involving the complete reversal of the life cycle of the insect, is a practical barrier against the establishment of species imported from such localities.

Widely differing ways in which insects may be introduced were briefly discussed and the known facts regarding the number of our principal imported crop pests were given. It was shown that the present method of packing the cargo of a steamer is admirably adapted to the successful transportation of insects, and of course the faster the steamer makes its way across the sea the greater the danger of importation of injurious forms.

The great difficulties of competent inspection were dwelt upon, but it was shown that a rigid inspection of nursery stock would be possible. The resultant value of such an inspection to the country was illustrated by examples of insects which such inspection in the past would have debarred from entrance. As further illustrating the possibility of this kind of inspection, the work of the State Board of Horticulture of California at the port of San Francisco was described at some length. The possibility of competent inspection of nursery stock in foreign countries before shipment to this country was also mentioned. The speaker followed with a partial list of insects of economic importance not yet introduced into this country, but which are still liable to be imported from abroad. It was shown, by referring to several familiar instances, that one great difficulty in the preparation of such a list arises from the fact that we have not only to guard against insects of known economic importance, but against many other species which in their native home have little economic consequence, but which in the more congenial climate of the United States may multiply to excess.

Tables were given showing the importations of nursery stock and plants, as well as fruit, at the different ports in the United States, and it was shown that the principal ports of entry to be guarded are those of Boston, Charlestown (Mass.), New York, Cincinnati, St. Augustine, Key West, Tampa, New Orleans, and Baltimore. This comparatively limited list would seem to indicate that with the aid of State officials, and particularly with the possible cooperation of foreign countries, an inspection and quarantine service need not be excessively expensive to the General Government.

As giving an idea of what such an inspection would mean, the speaker presented a table representing the inspection of steamers entering the port of San Francisco from July 2, 1894, to August 29, 1896. From this table it appeared that at San Francisco two hundred and thirty vessels carrying plants were boarded in the twenty-six months mentioned and all plants and trees found on them were carefully inspected. About one-half the plants and trees were found to be infested with scales or other injurious insects, and were disinfected or destroyed. It was shown that this inspection system, conducted under State laws, has been thorough and has undoubtedly saved the State of California many times the cost of the inspection. It was further stated, however, that inspection at San Francisco is but child's play compared with the amount of inspection which will be necessary at the port of New York.

In conclusion, the writer expressed his firm conviction that the establishment of such a service at the Eastern ports, while it might not be commensurate in the value of its results with that of San Francisco, would many times repay the horticultural interests of the country.

Mr. Howard's paper was followed by one prepared by Mr. B. F. Lelong, secretary of the California State Board of Horticulture. In the absence of Mr. Lelong the paper was read by the secretary, and was as follows:

THE INSPECTION OF TREES, PLANTS, FRUIT, ETC., AS CONDUCTED UNDER THE LAWS IN CALIFORNIA.

In compliance with a request from your president, Mr. E. H. Cushman, I submit herewith this paper, giving the methods of inspection and operation of the laws relative to the protection and promotion of the horticultural interests in California. In order that the subject may be fully understood, a short synopsis of the history of the State Board of Horticulture and its creation becomes necessary.

Prior to 1880 there were no laws to prevent the introduction of pests on trees, plants, fruit, etc., from foreign countries or the Eastern States, and very little was known by the fruit growers of the injury done by these enemies to fruit culture until those that were so introduced began to play havoc with the orchards and their crops. Among the insects first introduced were the San Jose scale (*Aspidiotus perniciosus*), the cottony cushion scale (*Icerya purchasi*), the red scale (*A. aurantii*), the yellow scale (*A. citrinus*), the oyster shell scale (*Mytilaspis pomorum*), the woolly aphis (*Schizoneura lanigera*), and others.

The need of establishing a State board of horticulture and the enactment of protective quarantine became apparent through the damage and annual loss sustained from these pests, and in 1881 an advisory board was appointed to look after the horticultural interests and adopt the necessary protective measures. In 1883 the State Board of Horticulture was created and quarantine laws were enacted. The present status of the fruit industry in this State is largely due to the efforts of the board and the State appropriates $15,000 annually for the prosecution of its work.

At the beginning the enforcement of the quarantine laws met with great opposition, which continued until the laws became better understood. In the first case, before a justice of the peace, to enforce the disinfection of return packages, the court ruled that it was "a strange law and unconstitutional." After years of hard struggle with our legislatures we succeeded in having laws enacted that have stood the tests of our courts, and now it would be almost impossible under our present quarantine system for injurious insect pests to obtain a foothold and commit the devastation that many such pests did before we had the present laws.

In 1883 the general law creating the State Board of Horticulture provided that said board be constituted of nine commissioners, to be appointed by the governor, covering as many districts, they to determine by lot the length of their terms (short and long), four to serve a short term (two years), and five a long term (four years), and all appointments to be thereafter made for four years. The law empowered the board to appoint an inspector of fruit pests and a secretary. The board was also empowered to pass quarantine regulations, under the general law, to be binding on all persons. The law relative to the inspector of fruit pests was not satisfactory, as he had no discretionary powers, and in 1889 it was amended so as to provide for a secretary of said board, he to be ex-officio chief horticultural officer of the State and to have the management and direction of affairs while the board is not in session, and to him all officers must report.

The office of quarantine officer was also created. He has charge of the enforcement of the quarantine laws, and his duty is to inspect all steamers and sailing vessels arriving from foreign ports. He is provided with one or more deputies when needed. Special agents are employed for special work as required.

In 1881 an act was passed by this legislature which provides that "Whenever a petition is presented to the board of supervisors of any county and signed by twenty-five or more persons who are residents or possessors of an orchard or both, stating that certain or all orchards or nurseries or trees of any variety are infested with scale insects of any kind injurious to fruit, fruit trees, and vines, or codling moth, or other insects that are destructive to trees, and praying that a commission be appointed by them whose duty it shall be to supervise their destruction, the board of supervisors shall within twenty days thereafter select three commissioners for the county, to be known as a county board of horticultural commissioners."

The law further provides that—

"It shall be the duty of the county board of horticultural commissioners in any county, whenever it shall deem it necessary, to cause an inspection to be made of any orchard, or nursery, or trees, or any fruit-packing house, storeroom, salesroom, or any other place in their jurisdiction, and if found infested with scale bug, codling moth, or other insect pests injurious to fruit, trees, and vines, they shall notify the owner or owners or person or persons in charge or possession of said trees or place, as aforesaid, that the same are infested with said insects, or any of them, or their eggs or larvæ, and they shall require such person or persons to disinfect or destroy the same within a certain time to be specified. If within such specified time such disinfection or destruction has not been accomplished, the said person or persons shall be required to make application of such treatment for the purpose of destroying them as said commissioners may prescribe. Said notices may be served upon the person or persons owning or having charge or possession of such infested trees, or places, or articles as aforesaid, by any commissioner, or by any person deputed by the said commissioners for that purpose, or they may be served in the same manner as a summons in a civil action. If the owner or owners or person or persons in charge or possession of any orchard, or nursery, or trees, or places, or articles infested with said insects or any of them, or their eggs or larvæ, after having been notified as above to destroy the same, or make application of treatment as directed, shall fail, neglect, or refuse to do so, he or they shall be deemed guilty of maintaining a public nuisance, and any such orchards, nurseries, trees, places, or articles thus infested shall be adjudged, and the same is hereby declared, a public nuisance, and may be proceeded against as such. If found guilty, the court shall direct the aforesaid county board of horticultural commissioners to abate the nuisance. The expense thus incurred may be a lien upon the real property of the defendant."

The quarantine regulations passed by the State Board of Horticulture are as follows:

"Rule 1. All consignees, agents, or other person or persons shall, within twenty-four hours, notify the quarantine officer of the State Board of Horticulture, or a duly commissioned quarantine guardian, of the arrival of any tree, plant, buds, or scions at any point of debarkation in the State of California.

"Rule 2. All trees, plants, cuttings, grafts, buds, or scions imported or brought into the State from any foreign country or from any of the United States or Territories, are hereby required to be disinfected, as hereinafter provided, upon arrival at any point where they are to be unloaded; and, furthermore, if any of said trees, plants, cuttings, grafts, buds, or scions are found infested with insects, or with any fungi, blight, or other disease injurious to fruit or to fruit trees, or to other trees or plants, they shall remain in quarantine fourteen days, or until the quarantine officer of the State Board of Horticulture, or a duly commissioned quarantine guardian, can determine whether the said trees, plants, cuttings, grafts, buds, or scions are free from live injurious insect pests, or their eggs, larvæ, or pupæ before they can be offered for sale, gift, distribution, or transportation.

"Rule 3. All trees, plants, cuttings, grafts, buds, or scions infested with any insect, fungi, blight, or other diseases known to be injurious to fruit or to fruit trees or to other trees or plants, and liable to spread contagion, are hereby required to be disinfected before being offered for sale, gift, removal, distribution, or transportation.

"Rule 4. All peach, nectarine, apricot, plum, or almond trees, and all other trees budded or grafted upon peach stock or roots, all peach or other pits, and all peach, nectarine, apricot, plum, or almond cuttings, buds, or scions raised or grown in a district where the peach yellows or the peach rosette are known to exist, are hereby prohibited from being planted or offered for sale, gift, or distribution within the State of California.

"Rule 5. All trees, plants, cuttings, grafts, buds, scions, seeds, or pits arriving from any foreign country, found infested with insect pests or their eggs, larvæ, or pupæ, or with fungi, or other disease or diseases hitherto unknown in this State, are hereby prohibited from landing.

"Rule 6. Fruit of any kind grown in any foreign country, or in any of the United States or Territories, found infested with any insect or insects, or with any fungi, blight, or other disease or diseases injurious to fruit or to fruit trees, or to other trees or plants, is hereby prohibited from being offered for sale, gift, or distribution within the State.

"Rule 7. Transportable material of any kind infested with any insect or insects, or their eggs, larvæ, or pupæ, or by any fungi, blight, or other disease or diseases known to be injurious to fruit or to fruit trees, or to other trees or plants, and liable to spread contagion, is hereby prohibited from being offered for sale, gift, distribution, or transportation until said material has been disinfected by dipping it in boiling water and allowing it to remain in said boiling water not less than two minutes, such boiling water used as such disinfectant to contain in solution 1 pound of concentrated potash to each and every 10 gallons of water.

"Rule 8. All trees, plants, cuttings, grafts, buds, or scions may be disinfected by dipping in a solution of three-fourths of a pound of whale oil soap (8 per cent) to each and every gallon of water. Said whale oil soap solution shall be kept at a temperature of 100° to 115°. Said trees, plants, cuttings, grafts, buds, or scions shall remain in said solution not less than two minutes. After said trees, plants, cuttings, grafts, buds, or scions have been disinfected they shall remain in quarantine fourteen days for subsequent inspection, and if deemed necessary by the quarantine officer of the State Board of Horticulture, or a duly commissioned quarantine guardian, for further disinfection.

"Rule 9. All trees, plants, cuttings, grafts, buds, or scions may be disinfected by fumigation with hydrocyanic acid gas, as follows: Said trees, plants, cuttings, grafts, buds, or scions shall be covered with an air-tight tent or box, and for each and every 100 cubic feet of space therein two-thirds of an ounce of c. p. cyanide of potassium (98 per cent), 1 fluid ounce of sulphuric acid, and 2 fluid ounces of water shall be used. The cyanide of potassium shall be placed in an earthenware vessel, the water poured over the said cyanide of potassium, afterwards adding the sulphuric acid, and the tent or box to be immediately closed tight and allowed to remain closed for not less than forty minutes. After said trees, plants, cuttings, grafts, buds, or scions have been treated with hydrocyanic acid gas, as above directed, they shall remain in quarantine for fourteen days for subsequent inspection, and if deemed necessary by a member of the State Board of Horticulture, or the quarantine officer of said board, or a duly commissioned quarantine guardian, for subsequent disinfection.

"Rule 10. All trees, plants, cuttings, grafts, buds, or scions imported or brought into this State shall be inspected upon arrival at first point of debarkation, and if found infested with mining scales (*Chionaspis biclavis*) or other injurious insects which can not be destroyed by the remedies required in rules 8 and 9 of these regulations, are hereby prohibited from being planted or offered for sale, gift, or distribution, and shall be proceeded against as a nuisance.

"Rule 11. Any person or persons having in their possession trees, plants, cuttings, grafts, buds, scions, seeds, or pits infested with any insect or insects, or with any fungi, blight, or other disease or diseases injurious to fruit or fruit trees, or to other trees or plants, and who refuse or neglect to disinfect the said trees, plants, cuttings, grafts, buds, scions, seeds, or pits, as is required by rules 8 and 9 of these regulations, after having been notified to do so by a member of the State Board of Horticulture, the quarantine officer of said board, or a duly commissioned quarantine guardian, the said trees, plants, cuttings, grafts, buds, scions, seeds, or pits shall be declared a public nuisance, and shall be proceeded against as provided for by law.

"Rule 12. Animals known as flying fox, Australian or English wild rabbit or other animals or birds detrimental to fruit or fruit trees, plants, etc., are prohibited from being brought or landed in this State, and, if landed, they shall be destroyed."

The laws and regulations promulgated by the State Board of Horticulture have been enforced without fear or favor both by the State authorities and county commissioners. The validity of all the acts passed has been questioned, and in suits brought their constitutionality has been upheld by the courts.

In order to prevent the possible introduction of new pests into our State on plants and trees brought here by passengers and importers from foreign countries, great precaution has been exercised. The quarantine officer is stationed at the port of San Francisco, and under the regulations of the board no tree, plant, or fruit can be landed until passed upon by him or his deputy.

In 1892 the following steamships and shipments were inspected:

Steamers from Japan and China	23
Steamers from Australia and New Zealand	12
Steamers from Sandwich Islands	8
Steamers from Central America	4
Sailing vessels from South Sea Islands	7
By rail from Eastern States	14
By rail from Southern States	9
Total	77

The following is a list of the kind and number of plants and trees inspected in the above shipments:

Ornamental plants	74,445
Fruit trees	53,893
Citrus trees	372,700
Citrus trees disinfected	47,700
Citrus trees found infected beyond cure and destroyed	326,500
Fruit trees destroyed	36,225
Ornamental plants destroyed	525
Total	911,988

Besides these the following shipments were inspected in the various counties upon their arrival:

From France, fruit trees and plants	1,022,221
From England, plants	16,926
From Eastern States, fruit trees	453,234
Ornamental plants	3,003
Total	1,495,384

The following shipments from within the State were inspected:

Fruit trees	186,000
Ornamental plants	2,900
Citrus trees	122,700
Total	311,600

The number of vessels inspected from December 4, 1894, to August 29, 1896; the number of plants, trees, etc., found on board; and the disposition made thereof and whence they came were as follows:

From December 4, 1894, to August 29, 1896, steamers were inspected from various countries as follows:

China and Japan	72
Australia and New Zealand	29
Tahiti	5
British Columbia	27
Mexican ports	17
Hawaii	35
Central America	40
Miscellaneous	7
Total	232

The trees, plants, and fruit found on board, and action taken in regard to them are as follows:

Total number of packages of trees and plants inspected and passed	930
Total number of packages of trees and plants inspected and destroyed	506
Total number of packages of trees and plants inspected and disinfected	474
Total packages	1,910

Plants (loose) inspected and passed	1,345
Plants (loose) inspected and destroyed	45
Total	1,390

Boxes of fruit inspected and passed	1,739
Boxes of fruit inspected and destroyed	3
Boxes of fruit inspected and disinfected	837
Boxes of fruit inspected and returned	100
Total boxes	2,679

Among the insect pests not yet known in the State are plum curculio (*Conotrachelus nenuphar*), which would mean the end of our prune industry if introduced; the pear Psylla (*Psylla pyricola*), which has been so destructive to the pear crops of New York; the bud moth (*Tmetocera ocellana*), which has also played great havoc in the apple orchards in western New York; the gypsy moth (*Ocneria dispar*), which has cost Massachusetts nearly half a million dollars to combat; the cigar-case bearer (*Coleophora fletcherella*), which did such great damage in 1894 to the orchards of western New York; the apple maggot and apple midge; and the peach yellows and peach rosette, which, if introduced, would mean the end of successful peach culture in the State.

The flying fox (*Pteropus rubricollis*), a great pest in Australia, was also found on board of steamers. These alight in orchards in the night in great numbers. Upward of one hundred thousand in a flock have often been observed—enough to damage an entire crop in a single night. The mongoose (*Herpestes griseus*), which is so destructive to poultry, especially in the Sandwich Islands and Jamaica, imported there from India in the hope of destroying rodent pests, was also intercepted. We are especially guarding against the introduction of the English or Australian rabbit, which would cause great damage if brought to our shores.

Every State should have protective measures of its own. The State Board of Horticulture of this State was the first to be created in the country. Other Pacific States have followed the example, but the boards are not supported by their legislatures as they should be. The creation of any such board without moral support and financial aid is of no value, and can accomplish no good to the State. Unless amply provided with means and stringent laws, the undertaking of establishing such a board should not be attempted.

Much has been said and written of late in regard to the San Jose scale, which has been introduced into the East and some of the Southern States on infected fruit from California. The fault, if any there be, lies with the people of those States, because they had no State legislation or protective measures to prevent the introduction of such pests.

Prior to 1880 California occupied the same position. We had no State legislation for the protection of the horticultural interests, and the Eastern and Southern nurserymen found our State a convenient dumping ground for all their pest-ridden trees, until we became alive to the dangers before us through yearly loss, and secured the creation of the State Board of Horticulture and the enactment of protective horticultural legislation. When we established a quarantine against Eastern trees, especially from districts where the peach yellows and peach rosette exist, the nurserymen of the East in convention declared that we had done so in the interest of home-grown stock, and that it was a boycott against the Eastern dealer. When we established the same quarantine against the introduction of nursery stock from one county into another the nurserymen here then declared it was a boycott in favor of nurserymen of each county. But what was the result? Each nurseryman pays strict attention and sees that his stock is clean before shipment, else it will be quarantined at destination and a certificate of inspection before shipment must accompany each shipment. The railroad company will not deliver the trees until passed upon by the local inspector. The Eastern nurseryman can ship his trees into the State, provided he complies with the existing laws and regulations, which insure to the grower clean and healthy trees, and to the nurseryman a better and larger trade. Or, in other words, nurserymen are compelled by law to provide clean and healthy trees to their customers and to be honest in their dealings. Each State should vie with the others to secure such legislation as shall benefit the entire nation. At present there is no law providing for the inspection of export shipments, or shipments going out of the State, and if all other States would have protective legislation it would compel the growers here to be more careful, and no infected fruit would ever leave the State. And while this would protect every State it would also help us in compelling shippers and growers to ship only clean and bright fruit.

In order to prevent the introduction of foreign pests into the United States, stringent laws should be enacted by Congress and a strict quarantine established at every port of entry. A law should also be passed providing for the inspection of all cuttings and plants sent by mail. At present what could prevent the introduction of the curculio or the gypsy moth into any State? There are many curious people who while traveling find curious things or things which they think curious and collect and send these curios to their friends through the mail, thus perhaps introducing pests into new localities. We have many instances where this has been done. The cottony cushion scale was carried from one locality to another on bouquets. The bouquets on wilting were thrown away and from these the pest spread. Flowers taken from one State to another should be carefully examined.

The flying fox before mentioned and the mongoose were also brought as curiosities. Only a few months ago a lady passenger on a steamer had a collection of chirping crickets from Mexico which are very injurious to vegetation and which she had raised as pets and would no doubt have liberated them had they not been killed by our officer on arrival.

Our quarantine officer has called the attention of the Department of Agriculture to the matter of there being no national law or regulation to prevent the introduction into the United States of even such a terrible pest as the Australian rabbit, and as there are other ports of entry outside of this State where they can be landed that it would be wise for Congress to enact a stringent law leaving no loophole for thoughtless or careless people to bring such pests, and when found to provide for their immediate destruction.

What I have said does not apply to the present existing condition of the fruit pests in the State. The cottony cushion scale, which caused so much damage, and through which the citrus industry had been about abandoned, has been practically exterminated through the agency of the ladybugs (*Vedalia cardinalis* and *Novius koebelei*) introduced from Australia. In many parts of the State the black scale (*Lecanium oleæ*) has been exterminated by the black ladybug (*Rhizobius ventralis*), also of Australian importation. This ladybug is becoming colonized in many portions of the State. The mealy bugs (*Dactylopius*) are being exterminated by a ladybug (*Cryptolæmus montrouzieri*). The San Jose scale in many sections has been exterminated by internal parasites, its natural enemies. Two internal parasites are at work on the yellow scale (*Aspidiotus citrinus*) infecting the orange, which keep it well in check. The *Rhizobius nanus* is doing good work in lessening the red spider, so destructive to our prune and almond orchards. So it will be seen that while we have suffered from the attacks of injurious pests our orchards now suffer but little in comparison with what they did, and by proper quarantine laws we hope to keep them and still improve their condition by preventing the introduction of new pests.

With the advent of the cottony cushion scale our citrus-fruit shipments decreased about one-half, while with the advent of the *Vedalia cardinalis* and *Novius koebelei* the output increased, and now we ship about ten thousand car loads annually. The codling moth is easily subdued, as are also all other pests of minor importance. The most troublesome pest we have is the red scale (*Aspidiotus aurantii*), for which as yet no effective parasite has been found, and we have to apply the hydrocyanic acid gas treatment, which is somewhat expensive, but effective.

The introduction of parasites to combat injurious pests is of California origin, and the results attained have gone on record as the greatest of boons to California interests. With California, which nature has decreed to be "the orchard of America," if not of the globe, other States are equally interested in protective legislation. When we destroyed a cargo of 325,000 orange trees from Tahiti infested by the mining scale, an insect that no remedy can destroy, as it lives under the bark, thereby preventing the scale from obtaining a foothold, not only was California benefited, but all other States shared with her, for if the scale had spread among our orchards it would have been only a short time when it would have been carried to every citrus-growing State in the Union, either on trees, scions, or fruit. The many thousands of infected trees and plants destroyed on their arrival in this State from foreign countries was a bar to their introduction into the East, for many such plants and trees are reshipped after landing; and while we grow the fruits of every zone, the whole world has the same interest in our success, or at least should have the same, that it has in the success and prosperity of other specially favored regions of our marvelous country.

Mr. Lelong's paper was the last of those prepared by request. It was announced that Mr. Gerald McCarthy, entomologist of the North Carolina Experiment Station, had a paper to present. The convention voted that the paper be read. It was as follows:

CROP PESTS AND THEIR REPRESSION BY LAW.

It is a fact that no practical horticulturist will dispute that crop pests are more numerous and destructive now than they were formerly, or only twenty-five years ago. Then to plant a tree or a crop and tend it with only old-fashioned care was to insure a harvest, and generally a satisfactory one. Now no one can secure even an apology for a crop without unremitting care and much "doctoring" of the plants.

The cause of this change is not hard to find. It is the boast of our time that methods of transportation have become so perfect that commerce, even in the case of such perishable articles as fresh fruits and living plants, has extended to the ends of the earth and our markets are supplied with fresh productions of all countries and climes. But the reasons and appliances which suffice to bring us such useful products suffice equally well to bring, and in fact do bring, us the crop pests formerly peculiar to different and distant climes. As to the seeming increase in the voracity of our native pests, this is more apparent than real. It is not that our native species of insects eat more than formerly, but rather that we, by our continual and extensive improvement in cultural varieties of plants, have rendered the latter more or less artificial and not fair representatives of the originally vigorous stock. We no longer dig up trees from fence corners or chance seed beds. We seize upon spontaneous variations and by our improved methods propagate and fix these so-called improvements. Improvements they may be from a human or economic standpoint, but from a physiological standpoint they are too often degenerations. We also plant these pampered trees in large blocks, and this fact explains why our more improved varieties become less and less able to withstand the assaults of their natural parasites.

Well, we must accept modern progress even with its concomitant evils, but by national measures and precautions we can greatly decrease, if not extirpate, many of these evils. We have not met here to-day to condole with one another, but to devise such legal measures as shall tend to prevent the introduction and dissemination of these parasites.

The parasites which trouble the horticulturist belong to three different categories, viz, fungi, weeds, and insects. Now as to the first class, ten years of practical experience as an experiment station botanist has convinced me that only State laws and local ordinances are of any use. The best that a national law can do for us is to prevent the sale of apparently diseased nursery stock, but none of the more destructive diseases, such as peach yellows, plum knot, or pear blight, appear with sufficient distinctness to be recognizable upon young trees or such as are usually sold by nurserymen. Laws against this class of pests must be directed against orchards on the lines of orchard hygiene and management. Such laws fall within the sphere of State influence alone.

Against weed pests a national law would be more effective than in the case of fungi, but it is doubtful if the results would be worth the expense. Most of our more troublesome weed pests are of foreign origin, and were originally introduced in foul samples of clover, grass, and field seeds. Of recent years the experiment stations have devoted much attention to seed testing, and the official association at its last meeting arranged for a uniform system which will have the effect of driving foul seed samples out of our markets.

Our third category includes insect pests, and here, I think, we have abundant grounds for governmental intervention. Insects possess greater powers of adaptation than plants. They pass through various changes of structure during the period of their life history, and in some one or more of these phases they are capable of remaining dormant and without food for an indefinite period. This enables them to secure dispersion, with and upon the plants they infest in their original homes, to all countries to which such plants or their fruits are carried by commerce. An efficient quarantine law by Congress to enforce entomological inspection of all imported plants, fruits, and seeds by a competent entomologist will go very far toward preventing the further introduction of foreign insect pests. A similar law regulating interstate commerce in plants and allowing free circulation only of such as have been examined and certified as free from insect parasites, will prevent the further spread of pests already existing in one or more of our States. The deplorable results of the absence of such a law is only too readily seen in case of the recent spread of San Jose scale in the Atlantic States.

The need of such a law is peculiarly felt in the new fruit-growing sections of the South. Hitherto, and until a comparatively recent time, the highways of commerce had not so extensively penetrated the Southern as the Northern States. Along with the disadvantages entailed by the lack of commerce, we have enjoyed the blessing of immunity from many of the most destructive pests which affect Northern fruit growers. We realize the danger of speedy infection unless we can secure protection by an enactment of Congress—the only possible source of an efficient law. North Carolina has already tried State laws, and so have other States, but when such laws promise any good their provisions are pronounced unconstitutional by the United States courts.

To recapitulate: (1) Pests of crops belong to three categories—fungi, weeds, and insects; (2) only the last class can be effectively dealt with by a national law; (3) insect pests can not be effectively or economically dealt with by State or local laws alone; (4) a national quarantine law against foreign insect pests and the enforced inspection and certification of plants which are objects of interstate commerce are the principal desiderata in such a law.

A general discussion followed the reading of the papers. The discussion brought out the various interests represented, and was continued until 1 o'clock, when a recess was taken until 3 p. m.

AFTERNOON SESSION, FRIDAY, MARCH 5, 1897.

DRAFTS OF BILLS COVERING STATE, INTERSTATE, AND INTERNATIONAL LEGISLATION.

The convention was called to order by the chairman at 3 p. m. The committee on legislation presented drafts of bills covering State, interstate, and international legislation, and gave a hearing to members of the convention upon the merits and defects of these measures.

COMMITTEE TO INVITE THE SECRETARY OF AGRICULTURE TO ADDRESS THE CONVENTION.

At 5 p. m., upon motion of Mr. W. W. Miller, of Ohio, a committee, consisting of Messrs. Miller and Farnsworth, of Ohio, and Hooker, of New York, was appointed to wait upon the Secretary of Agriculture, the Hon. James Wilson, and invite him to address the convention.

Secretary Wilson was introduced and made a brief address, in which he expressed a deep interest in the matters under consideration by the convention.

The convention adjourned at 8 p. m.

EVENING SESSION, FRIDAY, MARCH 5, 1897.

RESOLUTIONS RELATIVE TO THE EXTERMINATION OF GYPSY MOTH.

At the evening session the following resolutions, offered by Mr. Sessions, of Massachusetts, were favorably reported by the committee on resolutions and were adopted:

Whereas the State of Massachusetts has for the past six years been engaged in an effort to exterminate the *Ocneria dispar*, or gypsy moth, an important insect pest, which is as yet confined to a small area in the State of Massachusetts, and which preys upon the foliage of all deciduous and coniferous trees and shrubs, as well as upon the leaves of almost all vegetables and flowering plants, and which if not exterminated will spread all over this country; and

Whereas the State of Massachusetts has appropriated seven hundred and seventy thousand dollars, of which more than four-fifths has already been expended in the work of extermination with considerable success:

Resolved, That this is a question of national importance, and that the National Government should assume the work of extermination or render substantial financial assistance to the State of Massachusetts for that purpose, that the work may be carried to a successful conclusion and this continent be thus saved from the ravages of another terrible insect pest.

Resolved, That the committee on legislation is hereby directed to appear before the proper committees of Congress and advocate suitable legislation to carry into effect these resolutions.

RESOLUTION TO MAKE COMMITTEE ON LEGISLATION PERMANENT UNTIL NEXT MEETING.

The following resolution was offered by Mr. S. L. Lupton, of Virginia, and was adopted:

Resolved, That the committee on legislation be continued as a permanent body until the next meeting of the convention, with power to appoint an executive committee, whose duty it shall be to represent the general committee and the convention before Congress in securing such legislative action as may be recommended by the general committee or the convention, and the chairman of the general committee shall have power to fill vacancies in either committee.

RESOLUTION RELATIVE TO ADJOURNMENT.

Mr. Brown, of Connecticut, offered the following resolution, which was also adopted:

Resolved, That when this convention adjourns it shall adjourn to meet at the call of the president, vice president, and secretary, who shall notify the associations and institutions now represented in the convention and other associations of similar character.

The convention then adjourned to meet at 10 a. m. Saturday.

MORNING SESSION, SATURDAY, MARCH 6, 1897.

RESOLUTIONS RELATIVE TO STATE LEGISLATION AGAINST INSECT AND FUNGOUS PESTS.

The convention was called to order at 11 a. m. The following as to State legislation was reported by the committee on legislation and was adopted:

(1) That each State should provide for the proper inspection of nurseries and other premises for the detection of the presence of the San Jose scale or other dangerously injurious insects or plant diseases.

(2) That each State should provide for the proper and timely application of the most approved remedial or preventive treatment when found necessary.

(3) That should packages of nursery stock, etc., be shipped into a State contrary to law, i. e., without proper inspection certificates attached, it ought to be so handled as to receive proper inspection and not be destroyed unless condemned by proper and competent authority.

(4) That each State should cooperate in securing the passage and enforcement of a national law providing against the introduction and dissemination of San Jose scale and other dangerously injurious insects and plant diseases by means of imports or through interstate commerce.

DISCUSSION OF BILL RELATING TO INTERSTATE AND INTERNATIONAL LEGISLATION AGAINST INSECT AND FUNGOUS PESTS.[1]

The same committee then reported the draft of a bill relating to interstate and international phases of the subject. It was agreed that the proposed bill be read, discussed, and adopted by sections. (The bill as adopted is given on p. 29 in full.)

Section 1 was read by the secretary, and was discussed as follows:

Mr. ALWOOD. What I say now I should have said before the taking up of this section, but I failed to rise at the time. It is simply a word of outline. The committee thought it unwise to provide for any specific

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[1] No full official report of this discussion was made by the secretaries, but learning that Mr. Howard had made a stenographic report for his own information, the editor has asked his permission to publish it in the proceedings, as the discussion was interesting and important.

State law and decided to combine what might be termed international quarantine and interstate quarantine in one bill. The international quarantine is dealt with in the first four sections of the bill. This proposed measure intends to give to the Secretary of Agriculture large discretionary power, such as he already has in the operations of the Bureau of Animal Industry. The bill further provides that if a foreign country will make arrangements for proper inspection of nursery stock, etc., which the Secretary of Agriculture can accept, said stock may enter without quarantine either at the threshold of the country or between the States. The idea is to put no restriction that is not absolutely necessary upon the movement of the stock, but to permit the utmost freedom, so that the stock may be inspected either at the ports of entry or the ports of the country from which it is shipped. We find it unwise to propose a measure for quarantining fruit between the States. We did provide in the bill, however, for the strict regulation of nurseries—not the quarantine of farms, but the quarantine of individuals or corporations who sell or transport nursery stock. We went so far as to make it possible for the farmers to provide their own inspector under the rules and regulations of the Secretary of Agriculture. But the main thing is that the State shall provide and maintain inspection and that the Secretary of Agriculture shall accept such. If the State fails in this the Secretary of Agriculture is given large discretionary power to prevent the dissemination of infested stock by interstate commerce—not to touch it in the State, but to prevent it from entering interstate commerce. These are the main provisions of the bill and the main lines of thought which governed the committee.

Mr. **VAN DEMAN**. I do not know if there is anything in it and I throw it out as a suggestion, but regarding the word "fruit," might it not be construed to mean not only fresh fruit, but dried fruit as well, for instance, dried prunes, etc.? We might get into some complication over the lack of the word fresh before fruit.

Mr. **BISSELL**. It seems to me that would come within the discretion of the Secretary of Agriculture. I do not think it would be misconstrued.

Mr. **BEACH**. I see no reason why if we specify fruits we should not also specify nuts.

Mr. **POWELL**. The word fruit covers nuts.

Mr. **DANIELS**. I think the word "fruit" is a very important factor in the bill. What difference does it make to us whether a scale insect comes over in a prune or on a plant or tree? We do not care how it comes here. We do not want it to land on this coast if we can help it. Commerce between States is a family affair, but when a pest comes from abroad it is a matter that we have to deal with in a body. If it is discovered that some disease or insect is imported into this country, we want it stopped at once, as soon as discovered. Leave it to the discretion of our Secretary of Agriculture. We have implicit confidence in the man who fills that office, and I believe it is the desire of the people here that we leave it to him.

Mr. VAN DEMAN. I am fully in accord with the sentiments of the gentleman from California, and if the inspection of dried prunes and other dried fruits is practicable I am certainly in favor of it, but the question rises in my mind as to whether it would be practicable, because dried fruits are put up in sacks, boxes, etc., and it would be, in my opinion, impossible to properly inspect fruits in that condition.

Mr. POWELL. The chances are they would not need to be inspected, but if they did it could doubtless be arranged by raising lids and fumigating.

Mr. ALWOOD. The committee intended the application of this part only in case of some immediate danger from a certain district. Where this was threatened the Secretary of Agriculture could then check it and save the country from the introduction of some serious pest.

The section was adopted without amendment.

Section 2 was read and was adopted without discussion or amendment.

Section 3 was then read and was discussed as follows:

Mr. BARRY. I would like to inquire whether the committee considers it feasible to examine stock at a port of entry, or have the stock inspected at a port of entry, as in the manner suggested in this section—take, for instance, the arrival of 100 cases of nursery stock in one shipment; I would like to inquire how it is to be done.

Mr. HOBBS. It seems to me rather impracticable to treat the stock at the port of entry here. It occurs to me that this inspection and treatment of the stock should be done before it is boxed. I think we should require this.

Mr. ALWOOD. This was all considered by the committee, but we had no way of reaching it except to give the Secretary of Agriculture power to inspect it. Inspection has been beneficial in California. That can not be denied. The result would be in most cases that foreign countries would accept our law and shipments would be inspected on their side, otherwise leave it to the Secretary of Agriculture. I may say here that the Department of Agriculture has eyes that see very far. It knows what is going on in foreign countries and hence it can check stock at the port of entry.

Mr. BISSELL. The handling of nursery stock arriving in a vessel would be a simple matter compared with the other things inspected for the purpose of appraising value and fixing customs duty. The Secretary of Agriculture would certainly confer with nurserymen and have this matter handled in their interest.

Mr. BARRY. The section is apparently all right, but otherwise all wrong, because we do not see how it can be done. The committee admit that they do not see how it can be accomplished. It is all very well to make the law as you have, but there is something serious about it. We do not see our way clear to do it, and I shall not favor it until we do see our way clear. I shall object, because I can not, as a nurseryman in this country, consent to form a law which would restrict trade entirely. Every nurseryman imports more or less nursery stock, and this section would cut it off entirely. I may be wrong. To save time I will also refer to another part: "Shall be duly stamped or labeled." How do you interpret that? Is every particular item to be "duly stamped or labeled?" Suppose I have 100 cases, when would that be done?

Mr. **Bissell**. The Secretary of Agriculture would be authorized to use discretion in such matters.

Mr. **Barry**. Nursery stock is not like other goods. Prompt action must be taken, and if you are going to leave the thing in this indefinite shape I shall object to it. Do not think I am criticising this merely for the purpose of criticising. These simply appear to me to be difficulties in the way. Somebody may see a way out.

Mr. **Wardell**. I want to call the attention of the gentleman to the fact that we have a quarantine in our State [California]. We do open and examine goods. Usually they are goods in shipment for nurserymen throughout the State. The material arrives at San Francisco and much of it we have been compelled to quarantine. If our State can do it, certainly the great United States can do it. In regard to feasibility and practicability of inspecting these goods, that is a simple matter. Copies of the laws will be sent to men making shipments from foreign countries, and they will understand that trees and plants must be so placed, must be so packed, that they can be readily opened and inspected, otherwise they will be subjected to inevitable delay. Copies of the regulations will be printed and sent out, as a matter of course, so that no man will have to act in the dark, and no man can reasonably plead ignorance. Goods will be packed so that they can be readily inspected and readily treated if necessary, and that, I repeat, is a very simple matter. We expect the Secretary of Agriculture will meet this easily. It is not necessary to say how goods shall be packed. They may be placed in boxes with lids which could be opened and closed just as a trunk is inspected at the customhouse.

It is an easy matter to paste on the case a certificate stating that it has passed inspection. This is all that the bill anticipates. The gentleman, of course, recognizes the fact that we have struggled with these questions for many hours, and they have been fully discussed in committee. I do not see any reason why the United States Government can not quarantine against any dangerous insect, and do it efficiently, and do it so as not to inconvenience the nurseryman. In my State we are constantly inspecting goods, opening cases, etc., and if any contain injurious insects or disease they are promptly destroyed. What has been done can be done again.

Mr. **Barry**. The last speaker stated that there was no difficulty. I can see very grave difficulties. Goods arrive say in the middle of winter. They are put upon the platform in the customhouse when the the mercury is sometimes down to 10° below zero. If the case is opened and the goods exposed in twenty-four hours the contents will be utterly ruined. I think it is a very difficult matter. Shipments usually arrive in the month of January—sometimes in December, but generally in January. It would be very difficult to expose stock at this time without injury.

Mr. BISSELL. The stock could be inspected and properly certified before being sent to this country.

Mr. BARRY. Can the Government arrange to have it certified on the other side? I ask Mr. Howard whether such arrangements can be made.

Mr. HOWARD. The great majority of foreign countries employ efficient entomologists. No doubt their services could be readily arranged for this purpose. It would be comparatively easy for the the Secretary of Agriculture to overcome this winter difficulty also. No inspector would like the job of examining stock with the mercury 10° below zero. A barn or house could be erected for this purpose.

Mr. VAN DEMAN. It seems to me that the examination could be quite as easily made as in the case of meat inspection. France, Germany, and other countries will not accept from us a pound of meat that has not been inspected before leaving here, and if we can do that satisfactorily here it can be done there in the matter of nursery stock.

Mr. ALWOOD. The Government would not employ any but honest and responsible men to do this work. They would not be unreasonable. The committee believe that this inspection would be effective. We believe also that it would be difficult. We do not yet know all the details necessary. We believe the men who represent the Department of Agriculture are fully capable of meeting and mastering the case. These difficulties are not insurmountable. I wish to make the point of order that this matter has already been passed upon. Section 3 does not provide for inspection.

Section 3 was then adopted without amendment.

Section 4 was read and adopted without discussion or amendment.

Section 5 was then read and was discussed as follows:

Mr. BISSELL. Would it not be feasible to interpolate the word "fruit"? It seems to me a great deal of danger lies in the spread of the San Jose scale in that way, and if feasible we might require persons to have orchards inspected so that stock could be shipped without any trouble at all. Compel them to clean up the premises. I think it would be perfectly proper. It would not be a hard thing to do and would certainly prevent spread to a large extent.

Mr. POWELL. In regard to the shipment of scions or buds, how can the Secretary of Agriculture get at the farmers scattered all over the country who simply send away a few cuttings or buds? How can these little sendings be regulated?

Mr. Alwood. Section 8 provides that the Secretary of Agriculture can compel the inspection and treatment of shipments from private individuals, but I do not think we should leave the bars open to send stock through the mail.

Mr. Bissell. I move that we interpolate the word "fruit" after the word "scions." We certainly should be consistent and protect ourselves against each other.

Mr. Powell. I can not see how that will cover all these questions. If we depend on individual certificate it does not amount to anything. Every entomologist receives specimens of katydid eggs sent in *for* San Jose scale from farmers who want to know if they should begin to spray for the scale. If we rely on certificates from farmers and fruit growers who can not tell the difference between a katydid egg and the San Jose scale we shall not be very well off.

Mr. Hooker. As I understand it, by the regulations of the Secretary of Agriculture, persons sending out cuttings, scions, etc., would be required to give them proper treatment before sending them out. That, of course, would involve fumigation, no matter what kind of an insect was on them, and it would be destroyed.

Mr. Barry. If Mr. Alwood, for instance, sent to me for a small quantity of stock, would I have to get somebody to examine it first?

Mr. Powell. Get authority to treat it.

Mr. Barry. Would I have to get a certificate from somebody? If I would have to go to all that trouble I would not fill the order. I would simply tell Mr. Alwood that the goods were not in stock.

Mr. Alwood. It is quite easy to reduce discussion to the absurd. The committee realized how difficult it would be to make this measure perfect. It is not perfect. Many absurd things will come up in everything we undertake. I know that this individual treatment is not difficult. I know Mr. Hood, of my State, is doing it under my direction. It is not at all difficult to fumigate. Regulations properly drawn up will permit individuals to fumigate in the best manner known.

Mr. Barry. I was not joking about this individual case. It may look absurd, but supposing we receive from the experiment stations similar orders (and for a number of years we have been furnishing experiment stations all over the country with scions) sent at all seasons of the year. Can we procure a blanket form from the authorities to do that kind of thing? If we could not it would be foolish to attempt to send any.

Mr. Alwood. Under this law regulations may be made to provide for this case with the utmost ease. The Secretary of Agriculture can draw up regulations for that very thing. It is not difficult to treat insects. It is very simple. It may be done in a few minutes. I did not think you meant to be absurd. Your remark created a laugh, and it is easy to laugh at anything. The committee struggled with this matter a great deal.

Section 5 was then adopted without amendment.

Section 6 was read and was adopted without discussion or amendment.

Section 7 was then read and was discussed as follows:

Mr. TAYLOR. Does this prevent the mailing of infested scions or plants?

Mr. ALWOOD. That question has been asked a number of times and the committee had it under consideration.

Mr. TAYLOR. As I understand it, transportation by mail is not transportation by an individual or corporation, but transportation by the United States Government.

Mr. HOWARD. After the words "delivery to any person or persons" add "or to the United States postal service." I think this would obviate the difficulty.

Mr. WAITE. Can specimens be sent to the United States Department of Agriculture for identification?

Mr. WARDELL. I am of the opinion that the word transportation should be given a liberal construction, so that we can avoid making a lengthy addition to the bill. I believe it is covered in the bill, which reads, "transportation by any person or persons." The postmaster is a person or a thing, but should be a person.

Mr. TAYLOR. My object in asking the question was that the next section provides a penalty. Is the postmaster to be fined?

Mr. ALWOOD. We do not know how to deal with the Government. The Secretary of Agriculture can not deal with the Postmaster General.

Mr. BEACH. Some matters must be modified. It seems to me that having expressed our opinions on this matter we can simply leave it to the authorities to adjust according to their ideas.

Mr. VAN DEMAN. Let me say that a great many specimens are mailed that must necessarily be infested with living organisms in order to be of any value to the scientists who receive them. I move that we add the words "except for scientific purposes."

The CHAIRMAN. The question is on the insertion of the words "to the United States postal service for scientific purposes."

Mr. BEACH. It seems to me if we designate officials of the Government we are doing injustice to other scientists. Let us leave this matter to the discretion of the committee, having expressed our views on the matter.

Mr. ALWOOD. Allow me to say that this is a matter you have already provided for by leaving it in the hands of the committee. I think if you will leave it to the committee they will provide for that matter.

Mr. TAYLOR. I wish for my own information to inquire as to whether the committee considers that the section as worded would prevent private parties from taking scions from their farms in one State to their farms in another State without inspection and whether they would be liable to a penalty.

Mr. **ALWOOD**. We do not intend that any man should be favored because he owns two farms.

Mr. **TAYLOR**. The question is if trees are uninfested, not infested.

The **CHAIRMAN**. Mr. Taylor's question is a good one and ought to be considered by the committee.

Mr. **ALWOOD**. How can we make exceptions to regulations? We can not cover this in a bill.

Mr. **TAYLOR**. I wish to be clear on one point before the matter passes. Is it the understanding of the committee that a private individual would be subject to penalty for carrying uninfested stock?

Mr. **ALWOOD**. It is.

Mr. **TAYLOR**. I am not a lawyer, but this is unprecedented in Federal legislation. The State could refuse to admit stock inspected by the Federal authorities, but this, in my opinion, is a distinct encroachment upon rights and opens an entirely new line of legislation.

Mr. **ALWOOD**. The United States laws would not uphold such a law. We are not lawyers, but the distinct declaration of the bill is that it deals solely with interstate commerce.

Section 7 was then adopted without amendment.

Section 8 was read and adopted without amendment.

The preamble was read and adopted without amendment.

The bill was then adopted as a whole and read as follows:

BILL RELATING TO INTERSTATE AND INTERNATIONAL LEGISLATION AGAINST INSECT AND FUNGOUS PESTS.

AN ACT to provide for the inspection and treatment of trees, plants, buds, cuttings, grafts, scions, nursery stock, and fruit imported into the United States, and for the inspection and treatment of trees, plants, buds, cuttings, grafts, scions, and nursery stock grown within the United States which becomes a subject of interstate commerce.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled:

SECTION 1. That the Secretary of Agriculture be, and is hereby, authorized, at the expense of the owner or owners, to place and retain in quarantine all trees, plants, buds, cuttings, grafts, scions, nursery stock, and fruit imported into the United States at such ports as he may designate for such purposes and under such conditions as he may, by regulation, prescribe, and that he may appoint inspectors for the purpose of examining such trees, plants, buds, cuttings, grafts, scions, nursery stock, and fruit for the purpose of ascertaining whether they are affected by any dangerously injurious insect or disease, the importation of which will be prejudicial to the horticultural interests of the United States, and provide for the treatment of such when found necessary.

SEC. 2. That when such trees, plants, buds, cuttings, grafts, scions, nursery stock, and fruit shall be determined to be infested with any dangerously injurious insect or disease they shall be treated at the expense of the owner or owners in accordance with the regulations of the Secretary of Agriculture, or they shall be destroyed in case their condition is such as to warrant such destruction; but an appeal may be taken from the decision of the inspector to the Secretary of Agriculture if such appeal be taken within three days after such inspection, and the decision of the Secretary of Agriculture shall be final.

SEC. 3. That when such inspection shall show that such trees, plants, buds, cuttings, grafts, scions, nursery stock, or fruit are apparently free from dangerously injurious insects or diseases, a certificate to this effect, made in accordance with the regulations of the Secretary of Agriculture, shall be issued to the owner or owners thereof by the said inspector, and this certificate shall operate to release all the objects above specified, when duly stamped or labeled with the same, from further quarantine or restriction either at the said port of entry or in interstate commerce. Any person who shall forge, counterfeit, or knowingly alter, deface, or destroy any of the marks, stamps, or certificates provided for in the regulations of the Secretary of Agriculture on any such trees, plants, buds, cuttings, grafts, scions, nursery stock, or fruit, or who shall forge, counterfeit, or knowingly and wrongfully alter, deface, or destroy any certificate as provided for in said regulations, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not to exceed five hundred dollars or imprisonment not to exceed one year, or both, at the discretion of the court.

SEC. 4. That whenever it shall appear to the Secretary of Agriculture that any foreign country shall have provided proper and competent inspection and treatment, in accordance with the provisions of this act, for the objects above specified as being subject to inspection and treatment, he may, by proclamation or otherwise, accept such inspection and treatment in lieu of inspection performed by officers appointed by himself, which acceptation or proclamation by the Secretary of Agriculture shall relieve all such articles specified in the foregoing sections of this act, when properly stamped or labeled, from further quarantine or restrictions.

SEC. 5. That the Secretary of Agriculture shall cause to be inspected and properly treated, at the expense of the owner or owners, prior to their shipment, all trees, plants, buds, cuttings, grafts, scions, and nursery stock which are subjects of interstate commerce and which are about to be transported from one State or Territory or the District of Columbia into another State or Territory or the District of Columbia.

SEC. 6. That the said examination shall be made in the manner provided for by the rules and regulations prescribed by the Secretary of Agriculture, and that after such examination the trees, plants, buds, cuttings, grafts, scions, or nursery stock found to be apparently free from dangerously injurious insects or diseases shall be marked, stamped, or labeled for identification, as may be provided for by said rules and regulations of the Secretary of Agriculture, and when so stamped or labeled they shall not be subject to further quarantine or restriction in interstate commerce. Any person who shall forge, counterfeit, or knowingly alter, deface, or destroy any of the marks, stamps, or said devices provided for in the regulations of the Secretary of Agriculture on any such trees, plants, buds, cuttings, grafts, scions, and nursery stock, or who shall forge, counterfeit, or knowingly or wrongfully alter, deface, or destroy any certificate provided for in said regulations, shall be deemed guilty of a misdemeanor, and on conviction thereof shall be punished by a fine not exceeding five hundred dollars or imprisonment not exceeding one year, or by both such punishments, at the discretion of the court.

SEC. 7. That it shall be unlawful for any person, persons, or corporation to transport from one State or Territory or the District of Columbia, or for any person, persons, or corporation, to deliver to any other person, persons, or corporation, or to the postal service of the United States, except for scientific purposes, by permission or direction of the Secretary of Agriculture, for transportation from one State or Territory or the District of Columbia into any other State or Territory or the District of Columbia any trees, plants, buds, cuttings, grafts, scions, or nursery stock which have not been examined in accordance with the provisions in sections 5 and 6 of this act, or which on said examination have been declared by the inspector to be dangerously infested with injurious insects or diseases. Any person, persons, or corporation violating the provisions of this section shall be guilty of a misdemeanor, and upon conviction thereof shall be punished for such offense as provided in section 6 of this act.

SEC. 8. That whenever it shall appear to the Secretary of Agriculture that any State, Territory, district, corporation, firm, or person shall have provided proper and competent inspection and treatment in accordance with the provisions of this act for the objects above specified as being subject to inspection and treatment, he may, by proclamation or otherwise, accept such inspection and treatment in lieu of inspection and treatment by officers appointed by himself, which acceptation or proclamation by the said Secretary of Agriculture shall relieve all such articles specified in sections 5, 6, and 7 of this act, when properly stamped or labeled, from further quarantine or restrictions in interstate commerce.

SEC. 9. That the sum of fifty thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any moneys in the Treasury of the United States not otherwise appropriated, to carry into effect the provisions of this act.

SEC. 10. This law shall take effect on and after the first day of July, 1897.

It was voted that the committee on legislation be made a committee on ways and means, and, further, that each member of the convention contribute $1 to defray the necessary expenses of the convention.

Upon motion of Mr. Powell, a unanimous vote of thanks was extended to the proprietor of the Ebbitt House for his courtesy in providing a room for the use of the convention.

Upon motion of Mr. Barry, a vote of thanks was extended to those who read papers before the convention, to the officers in charge of the convention, and to the Ohio Horticultural Society for issuing the call for the convention.

A committee, consisting of H. E. Van Deman, S. L. Lupton, and M. J. Daniels, was appointed to wait upon the Secretary of Agriculture and request him to publish the proceedings of the convention as a special bulletin.

The convention then adjourned.

WESLEY WEBB,
M. J. DANIELS,
Secretaries.

SESSION OF THE PERMANENT LEGISLATIVE COMMITTEE.

The permanent legislative committee met immediately on adjournment of the convention and elected the following executive committee:

EXECUTIVE COMMITTEE.

W. B. Alwood, Blacksburg, Va., chairman.
F. M. Webster, Wooster, Ohio, secretary.
E. M. Wardell, Los Angeles, Cal.
J. H. Hale, South Glastonbury, Conn.
C. M. Hobbs, Bridgeport, Ind.

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U. S. DEPARTMENT OF AGRICULTURE.

[Report No. 58]

(see Report no. 65

CULTIVATION OF TOBACCO IN SUMATRA.

BY

EMILE MULDER.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1898.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Soils,
Washington, D. C., March 18, 1898.

Sir: I have the honor to transmit herewith a paper upon the method of cultivation and statistics of the tobacco crop of Sumatra and the physical features of the tobacco district, prepared at your request by Mr. Emile Mulder, of Starke, Florida.

Mr. Mulder is a son of the late associate justice of the supreme court of the Netherlands' East Indian colonies. He lived for many years in the East and opened and managed for a number of years a tobacco plantation on the east coast of Sumatra.

There is so much interest taken in the growing of cigar tobaccos in this country at present and so much competition from both Sumatra and Cuba, that it seems important to lay before our tobacco growers all the information possible in regard to the conditions and methods of production in the countries from which the competition is most severely felt. Sumatra tobacco competes particularly with the product from the Connecticut Valley, Pennsylvania, Wisconsin, and Florida. Florida and the Connecticut Valley produce a wrapper more nearly like the Sumatra than any other places in this country, yet on account of the very fine texture and the very thorough grading of the imported Sumatra leaf it brings readily from $2.50 to $5 per pound in our markets against 25 to 50 cents per pound for the very best grades of our Connecticut Valley leaf. The reason for this difference in price is partly fashion, as the Sumatra leaf makes a fine smooth wrapper, which looks well in a case; partly economy, as a pound will cover four or five times as many cigars as a pound of domestic wrapper and there is very little waste. Furthermore it is so well assorted as to length, color, and shade, that small manufacturers can maintain a particular brand with a small amount of wrapper leaf to select from, while with the domestic leaf the color so lacks uniformity in the case, that it is necessary to have a considerable stock on hand in order to maintain a uniform brand of cigars.

It is very desirable that our people be as fully informed as possible in regard to the conditions and methods which produce this tobacco, which seems to be desired by the present market demands. It is hoped that some of the descriptions will suggest valuable modifications and improvements in our present methods of growing and handling the crop.

Respectfully,

MILTON WHITNEY,
Chief of Division.

Hon. JAMES WILSON,
Secretary of Agriculture.

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CULTIVATION OF TOBACCO IN SUMATRA.

PHYSICAL FEATURES OF THE ISLAND.

Sumatra forms part of the Dutch East Indies, colonies of the Kingdom of the Netherlands (Holland), and is one of the four great Sunda Islands. The other three of the large islands of the group are Java, Borneo, and Celebes. This group of islands is situated in the remote southeastern part of the continent of Asia. (See frontispiece.)

The island of Sumatra is about 1,000 miles long and 266 miles wide in its widest part. The total area of the island is about 168,000 square miles. The famous tobacco region known as the East Coast of Sumatra covers only about 15,000 square miles. This district is almost directly under the equator. It is a province under the government of an officer called a resident.

A feature of this island is made by the Barisan Mountains, which run through its entire length. In the southwest some of the peaks in this chain have an altitude of 1,500 feet, while near the equator they are as high as 6,000 feet. About twenty of the peaks are volcanoes.

Another range of mountains runs parallel with the Barisan chain, and elevated plateaus connect them at certain points. There are also extensive valleys. There are several lakes in the island, the largest of which is Lake Semaway, 17 miles long and 6 miles wide, in Upper Padang. This lake is 1,170 feet above sea level, and discharges its waters into the Indragiri, which flows northeast.

Many large rivers traverse the island. On the east coast the most important ones are the Djambi, Indragiri, and the Siak rivers. Most of the rivers run approximately from south to north. In the tobacco districts, therefore, the northern estates are usually called the lower and the southern ones the higher or upper estates. The rivers are usually sluggish and form extensive deltas, from which wide, alluvial plains have been developed, at present covered with jungle and forest, except where these have been removed for the purpose of cultivation.

The whole tobacco area of the East Coast of Sumatra is frequently called Deli, because this is the principal district and produces the best and finest tobacco.

The population of the East Coast of Sumatra consists of about 1,480 Europeans, 223,600 natives, 7,600 Chinamen, 290 Arabians, and about 5,000 other people from various parts of the Indies, including British

India. The Europeans can be subdivided into about 200 government employees, 300 soldiers of the Netherlands Government, 150 persons in mercantile business, the remainder, about 800, being planters.

CLIMATIC CONDITIONS.

Sumatra, being immediately under the equator and in the path of the general oceanic currents, has a truly tropical climate. This is characterized by having a very uniform temperature and an enormous rainfall. The seasons are called monsoons; the east monsoon lasting from April to October, and the west monsoon from October to April. The following tables give the meteorological conditions of only two stations, Penang and Singapore, of the Straits Settlements, but they furnish an idea of the conditions on the East Coast of Sumatra. There is in addition a table of the average rainfall in Medan, the capital of the East Coast of Sumatra, for a period of thirteen years.

TEMPERATURE AND RAINFALL.

Penang, Straits Settlements, latitude 5° N., longitude 101° E.

MEAN MAXIMUM TEMPERATURE.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Deg.	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*
1885	91.0	92.1	92.5	92.1	89.8	88.9	88.0	87.5	86.9	87.2	87.6	88.4
1886	89.7	91.3	93.7	91.7	89.7	88.8	88.9	87.5	86.5	87.0	87.0	86.8
1887	89.7	88.3	89.5	88.0	88.5	87.5	87.9	85.2	87.3	86.7	85.4	86.7
Mean	90.1	90.6	91.9	90.6	89.3	88.4	88.3	86.7	86.9	87.0	86.7	87.3

MEAN MINIMUM TEMPERATURE.

	Deg.	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*
1885	73.0	74.0	75.4	76.7	76.2	76.2	74.9	74.4	74.7	74.4	74.6	74.2
1886	74.6	73.7	75.8	76.4	76.4	75.5	75.2	74.5	74.4	74.2	74.3	72.9
1887	73.8	74.2	73.5	74.0	75.0	74.0	73.7	73.8	74.4	74.3	74.0	73.6
Mean	73.8	74.0	74.9	75.7	75.9	75.2	74.6	74.2	74.5	74.3	74.3	73.6

MEAN MONTHLY TEMPERATURE.

	Deg.	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*
1885	82.8	84.0	85.1	85.4	83.8	82.8	82.7	81.4	81.2	80.8	81.0	81.4
1886	82.5	83.1	85.2	84.7	83.5	82.8	82.6	81.5	80.5	81.0	80.3	80.4
1887	81.6	81.3	82.1	82.3	82.2	81.6	81.5	79.6	81.6	80.4	79.6	79.9
Mean	82.3	82.8	84.1	84.1	83.2	82.4	82.3	80.8	81.1	80.7	80.3	80.6

MEAN RELATIVE HUMIDITY.

	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1884	70	72	67	64	81	78	81	80	82	81	83	75
1885	69	66	69	72	77	78	77	80	81	83	83	77
1886	71	70	67	73	77	77	77	79	81	79	80	73
1887	75	76	74	78	78	77	75	81	78	81	81	78
Mean	72	71	69	72	78	78	74	80	81	81	82	76

TEMPERATURE AND RAINFALL—continued.

Penang, Straits Settlements, latitude 5° N., longitude 101° E.—Continued.

INCHES OF RAINFALL.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1882........	7.39	1.50	3.46	4.12	17.78	5.21	7.64	16.53	9.84	35.09	8.55	9.19	96.30
1883........	2.76	1.35	10.99	6.70	9.83	5.83	5.86	6.78	18.16	8.16	17.82	2.93	97.17
1884........	3.62	2.87	.39	6.76	10.23	3.16	6.83	11.60	19.76	11.66	8.62	2.00	87.50
1885........	.27	1.44	1.92	2.72	6.87	9.47	11.11	14.29	21.67	21.14	7.96	8.30	107.15
1886........	5.73	2.16	.32	5.04	11.53	7.38	2.66	15.17	31.52	12.90	7.49	2.38	104.36
1887........	7.70	6.47	5.71	8.77	14.76	7.17	16.03	23.39	11.96	23.15	13.16	9.36	147.65
Mean...	4.58	2.63	3.80	5.68	11.83	6.37	8.36	14.63	18.82	18.61	10.60	5.69	111.60

NUMBER OF RAINY DAYS.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1885........	3	5	8	8	14	13	11	12	19	25	24	15	152
1886........	13	4	......	......	......	13	......	20	......	......	22	8	......
1887.... ...	17	16	15	20	18	12	12	16	16	24	25	18	209
Mean...	11	8	9	14	16	13	12	16	18	25	24	14	....

Singapore, Straits Settlements, latitude 1° 27′ N., longitude 103° 51′ E.

MEAN MAXIMUM TEMPERATURE.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Deg.	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*
1881....................	85.1	88.7	86.5	89.0	88.4	90.0	85.6	88.4	90.6	90.6	87.3	86.7
1882....................	86.7	85.6	89.0	88.7	89.1	89.6	89.4	88.4	86.9	86.8	86.1	85.5
1883....................	85.5	86.9	87.7	87.3	88.0	87.3	87.0	87.4	86.4	86.0	84.9	84.8
1884....................	84.5	86.5	86.9	87.2	88.8	85.7	86.7	87.2	86.4	85.9	86.5	83.3
1885....................	86.0	86.2	87.7	88.5	88.2	86.8	87.3	87.6	88.0	88.6	87.1	85.1
1886....................	86.6	87.0	89.2	88.9	87.5	87.5	87.5	85.6	86.4	87.4	86.0	84.4
1887....................	84.5	84.4	85.7	87.0	87.6	86.4	87.8	85.1	86.8	86.4	84.8	84.0
Mean....................	85.6	86.5	87.5	88.1	88.3	87.6	87.3	87.1	87.4	87.4	86.1	84.8

MEAN MINIMUM TEMPERATURE.

	Deg.	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*
1881....................	71.7	71.9	72.8	74.0	73.7	74.3	74.2	73.4	73.5	73.4	73.4	73.5
1882....................	72.5	72.5	73.2	73.5	73.2	73.3	74.5	73.3	73.2	72.5	72.6	71.6
1883....................	70.5	70.8	72.1	73.0	73.7	73.2	72.5	72.9	72.2	72.6	72.2	70.7
1884....................	70.7	70.2	71.1	71.9	73.1	72.4	72.7	72.9	71.8	72.1	72.4	70.3
1885....................	69.4	69.9	70.9	72.8	73.5	74.3	73.9	72.2	72.8	72.9	72.7	72.2
1886....................	71.8	71.4	72.3	73.4	73.4	73.0	73.9	72.9	73.5	73.5	72.5	71.6
1887....................	70.9	70.8	71.7	72.9	73.9	72.8	74.5	73.1	73.6	72.8	72.9	71.7
Mean....................	71.1	71.1	72.0	73.1	72.1	73.3	73.7	73.0	72.9	72.8	72.7	71.7

MEAN MONTHLY TEMPERATURE.

	Deg.	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*	*Deg.*
1881....................	78.4	80.3	79.6	81.5	81.0	82.1	79.9	80.9	82.1	82.0	80.4	80.1
1882....................	79.6	79.9	81.1	82.1	84.1	83.7	83.7	81.7	81.2	82.0	80.8	80.5
1883....................	79.4	80.4	81.4	82.1	82.9	82.2	83.1	83.0	81.5	80.5	80.2	79.0
1884....................	78.3	80.7	81.0	81.9	82.8	81.7	82.6	82.7	81.7	80.8	81.1	77.9
1885....................	80.0	79.2	81.5	82.4	82.7	82.3	83.0	82.9	82.3	83.0	81.4	79.8
1886....................	80.7	80.9	82.4	82.5	82.3	82.9	82.6	81.2	81.8	81.9	80.4	78.6
1887....................	79.1	78.5	80.3	81.8	82.1	81.0	83.3	80.6	82.1	81.2	79.8	78.7
Mean....................	79.4	80.0	81.0	82.0	82.6	82.3	82.6	81.9	81.8	81.6	80.6	79.2

TEMPERATURE AND RAINFALL—continued.

Singapore, Straits Settlements, latitude 1° 27′ N., longitude 103° 51′ E.—Continued.

MEAN RELATIVE HUMIDITY.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	P. ct.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
1882	......	......	......	80	76	76	74	76	79	78	82	84
1883	78	76	79	82	80	81	77	76	81	82	83	83
1884	84	79	80	81	80	83	78	78	79	83	82	83
1885	77	84	77	80	80	80	76	76	76	76	83	85
1886	82	76	79	81	83	81	81	82	82	81	84	82
1887	84	86	83	83	82	84	76	81	82	81	85	87
Mean	81	80	80	81	80	81	77	78	80	80	83	84

INCHES OF RAINFALL.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1881	13.49	1.91	8.30	6.14	8.70	2.65	5.01	5.40	5.48	10.41	11.23	12.23	90.95
1882	6.37	10.76	1.62	6.58	6.63	5.49	5.30	5.04	5.74	9.82	8.11	8.46	79.92
1883	2.95	2.39	6.30	7.87	7.62	4.83	2.71	3.10	9.38	7.41	6.03	6.15	66.74
1884	11.52	2.19	9.19	2.52	4.77	5.83	8.00	4.98	8.39	9.00	3.59	12.53	82.51
1885	1.99	6.29	1.17	5.40	7.22	10.11	3.82	2.34	2.81	3.96	10.42	15.48	71.01
1886	9.60	3.79	3.49	5.71	9.74	8.51	1.71	16.28	5.84	9.15	9.43	7.28	80.53
1887	11.79	12.90	5.46	9.12	7.12	10.23	13.97	14.39	8.53	6.92	10.28	12.98	123.69
Mean	8.24	5.75	5.08	6.19	7.40	6.81	5.79	7.36	6.60	8.10	8.44	10.73	86.49

NUMBER OF RAINY DAYS.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1881	14	6	18	9	7	8	12	7	8	15	18	18	140
1882	18	18	6	11	9	9	7	12	11	19	14	18	152
1883	5	6	10	13	11	9	10	13	16	18	21	20	152
1884	19	10	14	8	13	14	12	11	14	14	13	12	154
1885	6	14	5	9	20	14	9	8	13	8	20	18	144
1886	14	11	......	......	......	......	......	19	......	......	22	16	......
1887	23	21	21	19	18	18	10	19	16	16	20	24	225
Mean	14	12	12	12	13	12	10	13	13	15	18	18	......

Average rainfall at Medan for a period of thirteen years.

	Inches.		Inches.
January	5.1	August	9.0
February	3.6	September	10.1
March	3.6	October	9.4
April	4.9	November	10.2
May	8.1	December	8.7
June	4.7		
July	5.2	Total	83.1

As a rule the temperature increases slightly from October to March. The daily temperature ranges from about 70° F., at sunrise, to 94° at midday and is quite uniform throughout the season. Rain falls in all months of the year, but the greater portion of it falls between October and December, which constitutes the rainy season of the year.

SOILS.

The soils of the tobacco districts are mainly volcanic in origin. Those of Deli and Langkat, where is grown the finest and silkiest tobacco, of a rich brown color, are inclined to be argillaceous. The lighter colors of tobacco are produced on the loamy and sandy soils with a clay subsoil. Toward the southeast part of the district, where some of the newer tobacco estates have been opened, the soil is quite sandy, with a porous subsoil where a drought of one week often causes a serious loss. On the argillaceous soils of Deli and Langkat the tobacco can often stand a drought of three weeks or longer without much injury. In this district, however, they have frequent light showers which are of great value to the tobacco.

The Deli district slopes from the mountain to the east and, including Langkat, extends from 5 to 45 miles inland from the ocean. Experience has shown that land situated within 5 or 10 miles of the ocean does not produce as good a quality of tobacco as that grown farther inland. Where it is grown too near a large body of water it has a poor "burn." At the same time, the estates high up on the mountains have not had much success in growing a fine, silky wrapper. As a rule the lowlands, free from inundations and not too near the sea, have always given better results than the upper estates near the mountains.

A number of soils from the principal tobacco districts of Sumatra have been sent to the Division of Soils by the vice-consul at Padang. The mechanical analyses, showing the texture of these soils, are given in the accompanying table, followed by a brief description:

Mechanical analyses of tobacco soils from Sumatra.

No.	Districts.	Moisture in air-dry sample.	Organic matter.	Gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.01 mm.	Fine silt, 0.01 to 0.005 mm.	Clay, 0.005 to 0.0001 mm.
		Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
2207	Langkat	10.30	17.09	2.87	11.10	18.90	13.25	2.48	23.34	1.11	0.42
2202	do	7.61	26.49	.76	1.23	5.26	16.87	18.29	16.89	3.58	1.00
2200	Deli	12.25	23.41	.81	1.44	3.62	13.94	19.52	18.82	4.69	2.72
2209	Langkat	7.89	20.39	2.13	8.64	15.46	20.50	13.59	8.84	1.25	3.98
2199	Deli	3.77	12.88	2.41	10.56	15.51	16.59	14.81	13.93	4.01	5.20
2210	Langkat	7.79	7.86	3.35	7.77	20.11	11.71	14.17	17.56	4.57	5.75
2208	do	7.85	9.30	1.24	4.36	10.63	14.25	7.69	33.60	5.02	6.20
2195	Deli	3.07	9.95	.10	.30	2.86	19.91	32.91	15.98	5.94	7.20
2196	do	3.06	8.82	......	.30	2.73	18.76	28.74	17.81	8.65	12.75
2201	Langkat	3.43	7.81	1.35	1.89	6.47	18.71	24.63	15.74	6.74	13.82
2197	Deli	3.97	13.26	.98	2.90	5.95	9.45	14.95	12.67	12.58	25.47
2198	do	4.33	12.66	1.50	2.79	3.95	7.68	8.91	16.14	13.25	27.42

2207. This sample is from the Padang Brahrang estate of the United Langkat Plantations Company, Limited, in the district of Langkat. It is described as being adapted to a very good type of tobacco.

2202. This sample is from the Tandjong Goenoeng estate of the British Deli and Langkat Company, Limited. The description of this soil calls it a clay mixed with sand and indicates that it is very well adapted to tobacco; also to rice.

2200. This is from the Rimboen estate of the British Deli and Langkat Company, Limited. It is described as sand and clay and well adapted to tobacco.

2209. Sample from Tjermin estate of the United Langkat Plantations Company, Limited. It is said to produce a very fine leafy tobacco of good burning qualities.

2199. This is a sample from the Rimboen estate of the British Deli and Langkat Company, Limited, which for some reason is not well adapted to the production of tobacco. The plants have only eight or ten leaves and these are of third and fourth lengths. The reason for the inferior quality of the tobacco is not stated.

2210. This is from the Tjermin estate above mentioned, and is not well adapted to tobacco, as the subsoil is coarse and open and lacks humus and vegetable matter.

2208. This is from the Brahang estate above mentioned, and is said to produce a very fine wrapper leaf and to be adopted also to coffee.

2195. This sample is from the Bekala estate of the Deli Maatschappij. The soil is loamy and easily cultivated, and produces the very best kind of Sumatra tobacco imported into America, known as the "bull-eye speckled" tobacco. The sample is from a depth of from 4 to 12 inches.

2196. This sample is from the same place as the one just given. It is the subsoil at a depth of from 12 to 24 inches.

2201. This is from the Tandjong Goenoeng estate above mentioned. The subsoil is said to be volcanic and to contain much pumice stone. It is quite open and leachy and crops suffer from drought. For this reason it is not well adapted to tobacco, as plants die or are forced to early maturity before they have attained any size.

2197. This sample is from the Bekala estate above mentioned. The soil is rather heavy, containing a comparatively large amount of clay, and it is said there is no hardpan underlying this, and plants are liable to die about two weeks after being set out. For this reason it is not well adapted to tobacco growing. The depth of this sample is from 4 to 12 inches.

2198. This is a subsoil from a depth of from 12 to 24 inches, taken immediately under the sample just described.

THE INTRODUCTION OF TOBACCO.

Prior to 1862 a very good quality of tobacco was produced in the eastern portion of the Island of Java, in the same group of islands with Sumatra. This had been exceedingly profitable for the planters, but about this time the crops began to bring lower prices and planters were forced to look to other localities in which a better grade of tobacco could be produced. An Arabian trader called the attention of some of his merchant friends in Batavia, the capital of Java, to Deli on the east coast of the Island of Sumatra where he claimed there was a splendid opportunity to raise a particularly fine grade of tobacco. Little was known of Deli at this time, especially of the interior. After a persistent effort the Arabian succeeded in interesting a Java planter, Mr. Nienhuis, and in March, 1863, the latter accompanied the Arab to Deli to see what could be done in the matter. Mr. Nienhuis was received very cordially by the native sultan and succeeded in getting a firm foothold in Deli and securing several valuable franchises from the sultan. The following year Mr. Nienhuis was provided with sufficient funds by a mercantile firm of Rotterdam, and raised a crop of 50 bales of tobacco of about 176 English pounds to the bale. In 1865 he raised 189 bales. The first crop raised by Mr. Nienhuis in 1864 of 50 bales sold for 48 cents Dutch money, equivalent to about 20 cents American money, per 1.1 English pounds. The next crop (1865) of 189 bales sold for 149 cents Dutch money, or 60 cents American money, per 1.1 pounds. The 1868 crop of 890 bales sold at about 90½ cents American money.

The superior quality of this tobacco attracted the attention of experts to such an extent that in 1869 a number of capitalists of Amsterdam, headed by Mr. Cremer, concluded to undertake the raising of tobacco on a large scale. They organized the "Deli Maatschappij" ("maatschappij" means company) with an original capital of 300,000 guilders (about $120,000). Many companies and several private planters followed this lead, but the Deli Maatschappij has always been the most important organization of the east coast of Sumatra. At present there are 36 incorporated companies, with a total of 97 estates or plantations, and 38 private planters in the tobacco district of the east coast of Sumatra.

An estate to be at all profitable should contain at least 4,000 bouws, equivalent to about 7,000 acres. The land for such an estate is obtained in Sumatra in a way unknown in America. It is not bought outright, but a franchise or concession is obtained from the sultan for a period of seventy-five years under the sanction of the government. In the beginning of the tobacco industry a concession could be obtained for almost nothing. It depended mainly upon the native sultan, subject to the approval of the Netherland East India government, which was readily obtained. In recent years, however, it costs much more to obtain a concession, and so much of the best tobacco land has been taken up in Deli that it is difficult now to obtain the necessary quantity of land where good tobacco can surely be grown.

LAYING OUT AN ESTATE.

After the concession is obtained from the sultan and is approved by the government, the planter pays an annual rental, called hassill tanah, of 50 cents a bouw[1] per year. In the beginning the sultans were not very particular in the measurement of the land. The land was not accurately surveyed, and the boundaries were very carelessly given, so that usually much more land was obtained than had been asked for. In later years, however, this has changed, and now where a franchise is obtained the land is supposed to be accurately measured by a competent surveyor.

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[1] A bouw equals 7,097 square meters, equal to about 1¾ acres.

Only a portion of the 7,000 acres constituting an average-sized estate is under cultivation at any one time. When land was plentiful and concessions were easily obtained, the field was cleared and planted in tobacco but once in twelve or fifteen years, in order that the jungle should grow on it again and make it almost virgin soil. But since all the best land is now taken, this time is considerably lessened, and it is usual to allow but four or five years to elapse between successive plantings of the same field.

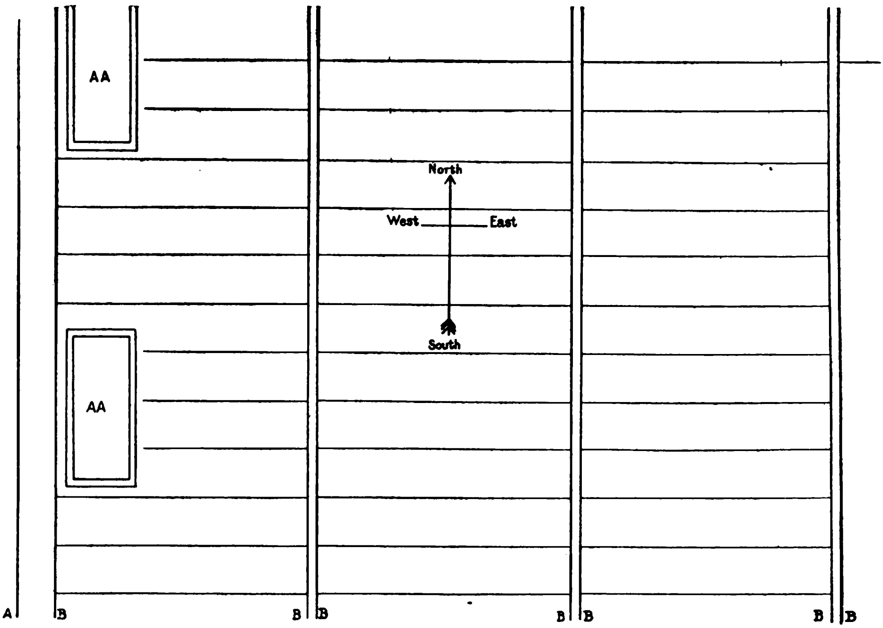

FIG 1.—Diagram showing arrangement of fields and sheds on Sumatra plantation. A B is the main plant road; AA, sheds; BB, small roads crossing fields parallel to main plant roads. The fields are each 60 feet wide from north to south and 960 feet long from east to west.

The estate is divided into a number of fields under a manager, or administrator, as he is there called. The maximum number of fields for an estate is about 400. The size of a field is usually 1⅓ acres, and this is given to one Chinese coolie to cultivate.

The arrangement of the fields is shown by fig. 1. The fields are each 60 feet front on the plant road by 960 feet deep and are divided from each other by small gutters to carry off the rain. Near the plant road are the sheds to receive the tobacco when cut. The plant road is 24 feet wide. Two roads, each 4 feet wide, run across the fields parallel to the plant road, dividing the fields into three sections. A cleared strip about 60 feet wide is left at each end of the tract to insure sunlight to the plants.

On a new estate the administrator usually commences with from 80 to 100 fields; occasionally an estate is started with 60 fields, but never with less. The second year 200 fields will be under cultivation, the third year 300, the fourth year about 350, while about the fifth year the full number of 400 fields will be reached. With this maximum number of 400 fields the administrator has enough ground to keep exchanging in order to let the land, after having been planted in tobacco for one year, lie idle, for a few years at any rate, to recuperate. This is considered an imperative necessity in Sumatra in order to maintain a superior quality of wrapper leaf.

INITIAL EXPENDITURES.

One of the most striking facts about the cultivation of tobacco in Sumatra, and a fact which will seem astonishing to the American planter, is the magnitude of the operations and the large amount of capital invested in the enterprise. The following list gives the principal items of permanent expense in obtaining a concession of 1,000 bouws, suitable for 200 fields, and for the equipment of the same with buildings, implements, and laborers.[1]

Traveling expenses, presents to native princes, surveying land, etc	$4,800
Clearing land for drainage, bridges, etc	400
Drainage, ditches, etc	1,200
Construction of main plant road	800
Manager's house	400
Two assistants' house	400
House for Chinese coolies	160
House for Javanese and Boyan coolies	120
Hospital, store, tool house, etc	160
Fermenting shed	640
Ox carts, 6 at $40 each, and 6 pair of oxen at $60 each	600
Horses, harness, carriage, etc	400
Expense of getting 60 laborers from Java	800
Expense of getting 250 Chinese coolies	2,400
Incidental expenses	1,600
Total	14,880

These are average prices, be it said, for an estate situated about 5 miles from the ocean. For places farther inland the expense of transportation will make the cost somewhat greater. The item for clearing the land is not the cost of clearing the fields, but simply for roads and ditches. The money paid for preliminary traveling expenses and presents to native princes is, of course, sunk; also the expense of getting the coolies.

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[1] The values in this bulletin, with the exception of the tables in the Appendix, are in United States money, based upon figures of some years ago, when the Mexican dollar was worth 80 cents and the guilder was worth 40 cents. On April 1, 1898, the Mexican dollar was worth only 44 cents.—M. W.

ANNUAL EXPENSES.

The average annual expenses of such an estate may be stated approximately as follows:

Salary of manager, at $200 per month	$2,400
Traveling expenses	200
Clearing land for 200 fields	800
Medical attendance, including medicine	480
Salary of 2 assistants, at $80 per month each	1,920
Chinese head overseer	240
Chinese or Singapore native clerk	144
Salaries of 60 Javanese coolies for one year	3,450
Watchman for one year	280
Rental to sultan	200
Government taxes	320
Twenty-five drying sheds, one for every eight fields, at $320[1]	8,000
Presses, scales, thermometers, etc	680
Pay of Chinese coolies, upon the supposition that each has an average, with sucker crop, of 15,000 plants, at an average price of $4.40 per thousand	13,200
Commission of Chinese foreman, 7 per cent of what his coolies have cut	924
Matting	80
Cost of fermenting, grading, sorting, baling, and hauling	5,600
Freight to steamer	80
Export duty of 1 guilder (40 cents) per bale	480
Total	39,478
Total cost at end of first year	54,358

BUILDINGS AND THEIR LOCATION.

In opening up an estate it is very desirable to have the buildings near the center, as the fields are constantly changing, and all of the tobacco has to be hauled to the curing shed. It is quite necessary, however, if there is a river running through the estate, that the establishment be situated near the river landing or upon the main road leading to the river landing, or to the railroad station. Great attention is given to the construction of the main plant road, which usually goes through the center of the estate, so that the fields will be distributed on either side. There should be a depth of at least 1,000 feet of land which can be cleared for the fields on either side of the road. The road is substantially built and thoroughly well drained, with ditches on either side. These ditches are from 3 to 6 feet wide, and about 2½ feet deep. Such a road usually costs from $24 to $32 per 600 feet.

The establishment includes a house for the manager, which, in the beginning, is a plain cottage, lifted from 6 to 9 feet above the ground, for the manager and one assistant. Later a better house is built. Chinese coolies, with the exception of the tandil, or foreman, are always single men. Sheds are usually built for them about 18 by 36 feet, one shed being intended for ten men. There is a small separate building of about 25 feet square for the head tandil; then there is a

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[1] These sheds need not be built anew every year. They last two to three years.

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general kitchen, consisting of a shed about 16 or 18 feet wide and 160 feet long, where every coolie cooks for himself, excepting in sorting time. Their food is then prepared for them in bulk by the storekeeper.

The Javanese coolie has a somewhat different house, as a great many of these are married men. They have small houses, about 25 feet square for the married men, while for the single men the houses are similar to those of the Chinese coolies.

There is a store on the estate under the control of a Chinese merchant, who usually pays for the expense of the building and who sells to the coolies at prices subject to the approval of the administrator. As the estate grows, branch stores are established in the several divisions of the plantation under the control of this merchant. When there are many Javanese coolies there is a separate store in the Javanese quarters, as the Javanese coolie is a Mohammedan and is not allowed to even touch anything coming from the pig, while this is the principal diet of the Chinese coolie.

The material shed is a building about 28 by 60 feet, and is usually covered with zinc or galvanized iron. This building contains the material and the extra attap or covering of the drying sheds. The building is usually insured for six or nine months each year. The horse stable, ox stable, and carriage sheds are all small open sheds, as the climate is so very warm that no closed stables are necessary.

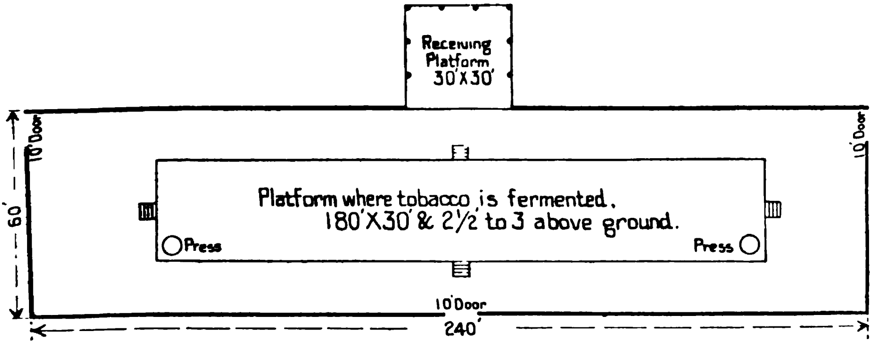
Receiving Platform 30'X30'
10' Door
10' Door
Platform where tobacco is fermented.
180'X30' & 2½ to 3 above ground.
Press
Press
10' Door
60'
240'

FIG. 2.—Ground plan of fermenting shed.

One of the important features of the Sumatra tobacco estate is the hospital. All of the laborers employed on the estate, including the Chinese and Javanese coolies, have to be treated free of charge by the planters in case of sickness. This is in all contracts for labor. At first the hospital is in a small building, but on some of the large estates, especially those of the older companies, fine modern hospitals have been erected, where all necessary medicines and appliances are kept, and where a regular physician comes at least once a week to visit and inspect the place.

The most important building of the establishment is the fermenting shed, which usually costs about $600 or $700. The ground plan of this shed is shown in fig. 2. It is usually about 240 feet long by 60 feet wide, not counting the two porticos at the doors on either side. It is 36 feet high and slopes gradually on either side to 10 feet in height. The whole length on both sides is filled with glass windows, so as to give plenty of light. There is a platform in the middle about 180 feet long and 30 feet wide. This is for the piles of tobacco in the fermentation. The platform stands on pillars 3 feet high, for the double purpose of having it freed from the moisture of the ground and to afford a good view over the whole fermentation shed. The platform is divided in the middle so that the coolies do not have to walk all around it in delivering the sorted tobacco. Some of these fermentation sheds are quite expensive, being made of brick and covered with attap, a sort of thatch, which will be described later.

On either side of the platform there is a space of about 15 feet which is kept free for the coolies who are sorting the tobacco according to the grades. While engaged in this sorting they sit on matting spread on the floor and have the benefit of the full light falling from the outside through the glass windows. The shed is usually built from east to west, so that the rays of the sun from December to February, the period when the sorting is usually done in Deli, will not fall on the side where the coolies are sorting.

There is an extension, marked "receiving place" on the plan, usually about 30 feet square and so constructed that plenty of light comes in over the top. This is where the tobacco is received from the drying sheds. There is a ditch 3½ to 4 feet wide and 2 feet deep around the shed to insure perfect drainage.

CHINESE COOLIES AND THEIR MANAGEMENT.

The Chinese coolie is an absolute necessity for the planter in Deli. It is doubtful if a laborer could be found that would serve all the purposes as well, taking into consideration the climatic conditions. He is admirably adapted to the work and understands what is expected of him. Europeans could not possibly stand what the Chinaman stands with impunity. The coolie is usually imported direct from China and at a very great expense, so that usually a number of planters club together and send one or two men to China to engage and bring over the coolies for them all. These coolies are called "singkehs," equivalent to our word "greenhorns." They know nothing about the cultivation of tobacco, and have to learn it from the Chinamen who have already been in Deli for a year or more.

The Chinaman does not plant and cultivate the tobacco on regular wages, but at so much per 1,000 plants grown. Later in the season, however, he does piecework in the fermenting shed. Each receives in the first place a few dollars down, usually $4, upon signing the contract. Then there is an advance of from $4 to $8 each, according to his appearance. This is advanced before anything is done by the coolie, in order to give him some capital to live on. The money so advanced is charged to the account of each individual, and is paid back when the tobacco is brought in. All the rest of the expense of getting the coolie over to the island and any bonus he receives is not returned directly to the planter. The Chinese coolie is bound to sell the tobacco to the estate. The manager gives him a field of land, about 1¼ acres, after it has been cleared of the larger trees. He then gives him the necessary implements for clearing and cultivating the land, the actual cost of which is charged up to his account. Further, on every pay day, that is, on the 1st and 16th of the month, he gets from $1.60 to $2 advance, according to his standing. This is charged to his account. There is no Sunday in Deli. These pay days are called by the coolies "haribesaar," or great day. On these days they are not expected to work in the field, but are paid off about 11 o'clock in the morning and have the day to themselves. The Europeans are paid by the month.

The Chinamen from Singapore or Penang, who have been one or more years away from China, and those who have worked one or more years on the tobacco plantations and have been able to pay their debts and reengage themselves for another year, are, of course, considered the most desirable coolies to have. They speak a little of the native language—Malay—and often a little English. It is almost necessary to have a few of them on an estate to teach those who come from China direct. They know exactly what is to be done and how to do it, and they understand, moreover, that it is to their own interest to work well. There is one serious drawback, however, that they are inclined to be a rowdy set. They are inclined to think that they know more than they do and that they have more rights than others, and they very often cause great trouble on some of the estates.

PREPARATION OF THE GROUND BY COOLIES.

Clearing the land of the largest trees usually costs about $4 for each field. This is charged to the account of the coolie, but never more than this sum is charged against him. When the coolie arrives, a field is assigned to him from which the largest trees have been felled some time before, so that they are well dried out and fit to be burned. The Chinaman then gathers up the brush and wood and chops up the trees and burns the land off until the growth is entirely reduced to ashes. Sometimes very large trees are left lying on the ground and the planting is done around them, as also around the stumps. No plows are used, except in very rare cases. It would be impossible to make any progress with a plow on land so full of stumps and roots and pieces of trees as these newly cleared jungle fields are. Occasionally in grass land a plow, drawn by two or more buffaloes, is used. The coolie is supplied with an implement called "tjankol," with which to work the ground to a depth of 12 inches. This takes the place of the plow in this country. He must, of course, very often use his ax to cut the roots, which are then exposed to the sun, and when dry are burned.

Where possible, the fields adjoin the main plant road and are laid off about 60 feet wide with a depth of 960 feet, where the ground is level. Taking off the places for the sheds, roads, and ditches, this gives about 1⅓ acres for actual cultivation. Between every two fields there is a small ditch, which runs entirely around it, to show the dividing line and to drain the land. The 960 feet depth of the fields is then divided, after it has been cleared, into three parts, by ditches which run into the main ditch on the side of the plant road. The system of drainage is very perfectly maintained. There is also a narrow road of 3 or 4 feet in width running between the three parts of the field. The growth is cleared for about 60 feet beyond the limit of the field, in order to admit the light and sunshine to the lower parts of the field.

SUPERINTENDENCE OF THE COOLIES.

About every 40 men have a foreman, called "tandil." He is a Chinaman who has had a few years' experience and has been promoted from the ranks of the coolies. This man receives usually 7 per cent of what his division of coolies gets and is entitled on pay day to $4, to be charged against his account. The head tandil is the head foreman of all the Chinamen on the estate. He is usually a civilized Chinaman who has been a coolie, then a tandil, and who has consequently had all the experience which it is necessary to have. His position on the estate is one of great importance, and many a row and difficulty between the coolies and the European assistants could not be fixed up without his assistance. His income depends upon circumstances, but is always more than any of the assistants, and is sometimes as much as the manager receives. He does not get as large a stated salary as the manager, but he has several perquisites, including the concession of the gambling tables on great days, which, altogether, means a large sum. The working hours when the coolies are expected to be in the field are from 6 a. m. to 11 a. m., then there is a rest from 11 a. m. to 1 p. m., then in the field again from 1 p. m. to 6 p. m., making ten hours a day. In working in the fermenting sheds the hours are the same, excepting that the noon rest is shortened one hour and the day ends an hour earlier, as there would not be light enough after 5 o'clock to do the sorting.

A very complete system of espionage is maintained over the coolie by the planters. They frequently run away to escape payment of their debts, or for some crime that has been committed in the frequent affrays that take place. There is an agreement between some of the planters that a coolie shall always be given a letter of discharge when he leaves a place honorably, and they will never engage a coolie outside of China or Singapore unless he is provided with a proper letter of discharge. This letter contains the name and a full description of the person. Nevertheless, there is a large traffic in these letters, and they often sell for $10 or $15 apiece. If a person is caught using a discharge letter not intended for him, the letter is confiscated and the coolie is sent to jail. No coolie is allowed to leave the estate during the year and visit another estate, or go to a neighboring city without first getting a written pass. The color of the pass is pink, while the discharge letter is a light green. A pass is usually issued for from one to ten days. Whenever a coolie is met on the public highway by a police official his pass is demanded, and if it is not shown he is confined in jail until the police can find out from what estate he has come. A reward is offered of $2 or $3 to the guard who returns the person, and this amount is charged up to the coolie himself. Notwithstanding the strictest precautions, there are many who run away in Sumatra and are never brought back. Any manager belonging to the planters' committee engaging a coolie without a proper discharge letter is liable to a heavy fine from the committee.

THE DRYING SHEDS.

There is generally one drying shed (fig. 3) for eight fields. These sheds are usually 72 feet wide by 180 feet long and 36 feet from the ground to the ridgepole. The sheds are placed, if possible, near the main road of the estate, and are nearly always built from north to south, to protect them from the heavy winds which frequently prevail in Deli. The material for the construction of these sheds comes almost entirely from the jungle, with the exception of the covering for the roof and sides. There are seven rows of posts. The row in the center has posts 36 feet high; one row on each side has posts 28 feet high, and on each side of this there is a row of posts 20 feet high, and on either side again a row 12 feet high. In each row there are 31 posts. They are commonly sunk 4 feet in the ground. The building of the sheds is frequently given out by contract to Malays. Sometimes the material is all furnished by the contractor and at other times by the estate.

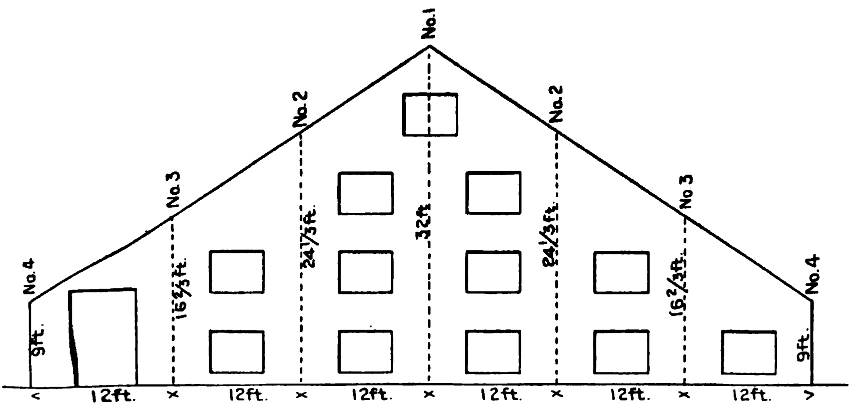

FIG. 3.—Front elevation of drying shed, windows 4 by 5 feet; door 9 feet high.

These sheds are only expected to last for two years, after which time they are abandoned and new ones built in other fields that have been taken up. They are therefore not very substantially put together. They are not covered with planks, but with rough wood from the jungle. The roof is covered with attap. This is made of a sort of palm called nipa-palm. The leaves of the palm are bent around a bamboo about 6 feet long. The width of the whole when finished is about 1½ feet, so that a surface of about 9 square feet can be covered with each bundle. These are attached to the laths on the roof by rattan strings in such a way that each attap covers the next one by about 5 inches, in order to prevent leakage. This makes a very substantial and durable covering for the purpose for which it is intended. When the shed is abandoned this attap is removed and stored away until needed for another shed. It shrinks somewhat on drying, and when it is put on a new building it must be crowded somewhat closer. The doors and windows are made to give very thorough ventilation when open. The doors are small, as carts are never drawn into the shed, the tobacco all being brought in by hand.

The supports on which the tobacco is hung are usually set at the following distances: The first one is 5½ to 6 feet from the ground, the next one is 2½ feet higher, while the next four usually have a distance between them of 5 feet. Of the six compartments into which the shed is divided lengthwise by the rows of posts only five are used for hanging up tobacco; the sixth one—that is the one on the end of which are the two doors—is not used to hang tobacco, as there would be danger of damage by the coolies bringing in the fresh tobacco. There is a small platform called the "lantih," about 12 feet square, upon which the tobacco is stripped from the stem when it is cured.

PLANTING AND CULTIVATING.

As a rule, each coolie makes and keeps his own plant bed in the front part of the field near the road. Occasionally a fine piece of land is picked out where all the beds are made together, but in this case every coolie has his own bed. The usual size of the beds for each coolie is about 3 by 18 feet, or 54 square feet, upon which is put rather less than half of a cartridge-shell measure of seed. As it is difficult to give a definite measure of the seed required on account of the change in its vitality and the change in seasons, a number of trial beds are usually sown, so that the manager can know what is the best measure of seed to sow. It is important that the beds be not too thickly sown. The bed is about 1 foot high with a ditch all around it. The seed is kept by the manager in quart bottles, and this seed bottle is never given to the Chinaman. Each coolie gets a paper package with enough seed for one bed at a time. He mixes the seed well with dry wood ashes, about 2 or 3 quarts of ashes for each bed. After the bed has been thoroughly prepared, cleared of all roots and carefully raked over and well watered, the mixture of ashes and seed is carefully spread over the surface. Every six days a new seed bed is made, in order to be sure to always have fresh plants of proper size on hand when the time comes for transplanting. A bed of this size will produce about 2,000 good plants as a rule. As a coolie plants about 10,000 plants on an average in his field, it would be expected that he would make about 5 of these seed beds, but as a rule every coolie makes from 14 to 16, and sometimes as many as 20 seed beds.

When new land is used it is not necessary to burn the beds first, as little trouble will ensue from grass and weeds; but if old land is used it is necessary to burn the land over, as is done in the United States.

Before sowing the seed bed is covered with a sort of roof. On one side of the bed sticks are put in about 3½ to 4 feet high, and on the opposite side sticks of from 3 to 3½ feet, thus giving a gentle slope to the roof, which is made of straw or prairie grass. This can be put close together or spread out as desired, in order to regulate the amount of heat received by the small plants. In this way the seeds and tender plants are protected from the intense heat of the East India sun. Beds are always made from east to west lengthwise. After eight or ten days the roof can be spread out considerably in the morning and evening, and after a month or five weeks it can be taken off and kept to serve for another bed. The plants are usually ready to be transplanted in from forty-five to fifty days after the seeds are sown.

The white ants and occasionally caterpillars and worms are very destructive in the seed beds. The best way to get rid of the pests is by taking them off by hand. For this purpose the Chinaman goes over the bed very early in the morning or in the evening with a torch. Sometimes a mixture of water and *akar toeba* (root of a plant called toeba) is applied with good success to keep off the pests.

SETTING OUT THE PLANTS.

Transplanting begins about the last of March and is continued until the beginning of June. Experience has shown that after that date the results are not so satisfactory.

The field is first thoroughly broken up to a depth of a foot with the tjankol. The coolie then carefully clears the piece which he intends to plant of all stumps, grass, etc., and rakes the ground carefully, so that it has a smooth and even appearance. This is done the day before the transplanting. The coolie is then provided with a plant string of the same length as the width of the field, namely, about 60 feet. Each end of the string is securely attached to a stick 3 feet long for the purpose of laying off the rows. The string itself is divided into spaces of 2 feet by securely tying red or blue ribbon or cord at these intervals. These show where the plants are to go in the row. The coolie then provides himself with a plant stick about 5 feet long and sharpened at each end. The middle of the stick is flattened somewhat that it may be held more securely. After stretching the plant string across the field the holes are made with the stick about 4 inches deep and 3 inches wide. In this way about 250 or 300 holes are prepared in rows 3 feet apart, the holes in each row being 2 feet apart. The holes are watered immediately before the plants are put in.

Early the next morning after these holes are made the coolie pulls out about 300 of the best plants from his plant bed. Those which are fresh looking and which have a healthy green color are, of course, selected. The pulling is done when the dew is on the plant. The bed is first wet thoroughly with water and the plants are then pulled out carefully, so as not to injure the roots. A little earth is left on the roots. The plants are put upright in a basket in such a way as to support each other. They are usually from 3 to 6 inches long at the time of pulling. When the required number has been pulled the tops are sprinkled with water and the basket is covered with a piece of cloth. The basket is then taken to the coolie's lodging, where it remains until 4 o'clock in the afternoon. After pulling the plants the plant beds are again watered and the loose dirt is carefully packed again. When the seed bed begins to look yellow and the plants get old and sickly it is abandoned and raked over. By this time another bed, which was planted six days later, will be ready, and thus the coolie has a constant supply to keep him at work until his field is planted.

About 4 o'clock in the afternoon, when the rays of the sun are not very strong, the coolie takes the basket and drops a plant near every hole. When all are dropped he commences to plant. He holds the plant in the middle of the hole with his left hand and with his right hand presses the dirt around the roots carefully but firmly, so that he can give the plant a slight pull without removing it.

SHADING THE YOUNG PLANTS.

If there is time, the same evening, or otherwise early the next morning, the coolie commences to put in the shade planks. These are in the shape of a shingle, are made of very thin, light wood about 7 or 8 inches long and about 5 inches high. They cost from $8 to $9 per 10,000. Each coolie supplies himself with about 3,500 of these planks, which are added to his account, but if he desires to do so he can return them after use and get credit for what he returns.

The planks are put in slanting over the young plants in such a way that the opening goes to the east. This shuts out the noonday heat, and lets the sun shine on the plants only early in the morning. As the plants grow the planks are straightened up. If the plants grow well and nothing happens to them, and especially if the weather is not too dry, the shade planks are taken away about twelve or fifteen days after transplanting. When taken away the soil is scraped up against the stem of the plant to protect it from the hot rays of the sun.

The process herein described of setting out 300 plants is repeated and continued from the new seed beds, which come on until the last one of the 10,000 plants has been set out in the field of about 1⅓ acres.

PUNISHMENT FOR CHEATING.

The coolie often attempts to plant short, as it is called—that is, to plant less than 2 by 3 feet—in order to get a larger number of plants on the field. It is the duty of the European assistant to enforce the rule of planting very rigidly, and sometimes the coolie is compelled to pull out his plants and replant them the next day. Many disturbances arise over this question and serious quarrels are the consequence. When the short planting is discovered by the European assistant the next day after it is done it is a good lesson for the coolie, and he is not apt to plant short again; but after a few days have passed and the plants are growing it is rather hard to have to pull them out and reset the plants pulled out.

STIRRING THE SOIL AND WATERING.

The cultivation of the crop is never done as in this country by plows or cultivators, but is all done by hand with the tjankol. The field is usually cultivated three times during the season. The first time the plants are about 9 inches high. The coolie places himself between two rows of plants and makes a little gutter in the middle, about the width of his tjankol, which is about 8 inches wide. He takes dirt and loose earth up with this instrument and puts it against the plant, evenly divided on each side. It is absolutely necessary to make this quite level, as the plants under no circumstances must be allowed to stand in a hole where the water could accumulate. This first cultivation leaves a small gutter between the rows about 4 inches deep, which also serves the purpose of allowing the rain water to run off to the outside ditches. Before planting the coolie goes around and carefully clears out the ditches around the field so that they may be prepared to perfectly and rapidly carry off the heavy rains which can still be expected. While cultivating his crop he does the same thing and uses the mud out of the ditches, after first drying it in the sun, to put against the plants. If the weather should be very dry for a few days immediately after planting, the coolie often has to water his young plants by hand. For this purpose and for watering his seed bed he uses clean water from a stream or well and not the dirty water from the ditch.

The heavy rains commence to fall sooner on the uplands—that is, those in the south part of the tobacco district—than in the lowlands, therefore the transplanting and cultivation begins sooner on the higher estates than on the others.

The second cultivation takes place when the plant is about 12 or 15 inches high. The little gutter in the middle of the row is made deeper and the soil which comes from it is again put against the plants, as in the first cultivation. Before doing so, however, the coolie takes off the leaves on the bottom of the plant to the height of about 3 inches and puts them around the stem and packs the soil on these. He is exceedingly careful in breaking these leaves to see that the broken end is covered up immediately, so as not to expose the injured parts to the sun. At this second cultivation the plants are carefully examined and all suckers are removed. These are broken off and buried around the stem of the plant in the same way as the leaves, so as to protect the stem.

The third and last cultivation takes place when the plants are about 2 feet high. The rows by this time stand in rather high ridges, so that they are well protected from the heavy rains.

DISEASES OF THE PLANTS.

The tobacco plants are subject to injury in a number of ways. Frequently a worm settles in the stem of a plant or in the stem of a leaf and feeds upon the plant until it becomes sickly. These sick plants are recognized by the appearance of the leaves, some of them becoming contracted. The only remedy is to pull up the plant and work the ground over. Sometimes the plants put in the ground in the same place are again troubled in the same way. The coolie, who does not wish to lose the plant, will often try to doctor it by cutting the stem open and taking the worm out, but the plant so treated will never amount to much and it is best to pull it up and destroy it.

Another injury causes the so-called gilas or corkscrew plants. The plant at a certain height suddenly becomes bent in a crooked way and the leaves are strangely curled. The only thing to be done in this case is to cut the stem off where the twist commences, but even this will not always remedy the fault, and then the plant has to be taken out.

There is also the "phesem" or "white-heart," which causes the tobacco to suddenly become very light in color. This frequently occurs after heavy rains. There are also so-called "lightning" plants, which have white specks and frequently a white appearance throughout. These also have to be thrown out. Frequently, also, the plants have rotten, empty stems and leaves that commence to die before the plants are half ripe.

Resetting to replace such losses is practiced during the time just after a rain and as soon as possible after the planting. This is the only chance for these plants to catch up with the main crop. If the resetting is done too late the small plants never amount to much.

FERTILIZERS.

Fertilizers are very seldom used in Deli, and never on new land. In the grass lands it is sometimes necessary to use fertilizers. In this case about 300 pounds of guano are used to a field after first mixing it with the same amount of wood ashes. It is applied either dry or in liquid form. When applied as a liquid it is well mixed with water, about one quart of the guano to an ordinary bucket of water. It is then applied to the young plants shortly before the shade planks are taken off, and it is only given to those plants which seem yellow and weak. In applying the liquid a small ditch is made about 2 inches wide around the plants and 1½ inches deep, and a quantity of the mixture poured in. After the mixture has soaked in, the ditch is covered with the soil that was taken out. It is very desirable to apply this mixture immediately before a rain. It is necessary for the European assistant to see that the coolie does this work properly and that the fertilizer is not applied too near the roots, as it is then liable to seriously injure the plant. When used dry the fertilizer is scattered broadcast at the time the field is planted. Besides guano, boenkil is frequently used in the same way. This is a fertilizer made in cakes, and consists mainly of cotton-seed meal. Horse and cow manure is also used to some extent, but the quantity available is not large enough to be of any particular account.

TOPPING AND RIPENING.

When the plant has been about forty or fifty days in the field the flower buds begin to come out and are pinched off, just as in the United States. The appearance and vitality of the plant determines how much shall be pinched off in the topping. It is usual to leave from 15 to 18 leaves, but in some extraordinary cases as many as 24 leaves are left on. After the plants are topped suckers come out in great quantities and the coolie has to keep them broken off. This is usually done in the morning.

If the topping has been done at the proper time the tobacco is usually ripe and fit to be cut about three weeks later. No definite and positive rule can be given which will indicate the ripening of the plant, and, in fact, there are various opinions upon this matter. The tobacco when ripe has a yellowish appearance, the leaves, especially the inside ones, have little light brown lumps and take on a somewhat swollen appearance, while the edges commence to curl up toward the underside and assume a dark brown color. The time from transplanting to harvesting in Deli is from 70 to 90 days.

WORMING.

One of the most important features of the work with tobacco in Deli is the worming. Here, as elsewhere, the plants are troubled a great deal with these pests. From the beginning of the planting until the tobacco goes into the barns or sheds the coolie has to look for worms. He usually does this early in the morning or at night when there is moonlight. No poisons are used, but the worms are caught by hand and killed. The coolie realizes that it is to his own interest to have the leaves free from worm holes, and rarely has to be urged to attend to this matter. Still, if some of them neglect it, and the appearance of the field shows it, they have to be set at it by those in charge.

SAVING SEED.

At the time of topping, a few plants are left for seed. The best, finest, and healthiest looking plants are selected for this purpose. These, of course, are not topped, but are allowed to grow and blossom at their full height. Some of the planters take off all the leaves when they grow large enough, but usually only those at the bottom are removed. If any of the plants that have been selected for seed show subsequent signs of sickness they are, of course, immediately topped and harvested when ripe. When ripe the little balls containing the seed are carefully cut off with a knife or scissors. The seed plants frequently grow as high as 10 feet, and it is necessary in gathering the seed to use a bench to stand on. The cutting must be done very carefully so that the seed shall not fall out. When gathered the balls are taken to an assistant's house and spread out on a large piece of linen or calico. They are then put out in a moderate sun, or, better, in a place where there is a warm current of air. When perfectly dry the seed is pressed out of the hull by hand and the hull thrown away. The seed is, of course, full of dirt and fragments of the hull which must be removed. After it has been thoroughly dried it is put through a sieve or strainer in the open air, by which process, and by blowing the seed as they fall, the dirt is removed as much as possible. The seed is again dried and is put through a small seed mill. As it comes slowly out from the mill a wheel is operated which blows away the lightest seed and chaff and allows only the heaviest and best seed to fall near the mill, where they are caught on sheets. The seed is divided into two grades, No. 1 and No. 2, according to the weight. There is little difference, but No. 1 is considered somewhat the better. The seed is then put up in quart bottles and well corked, or put in clean, empty 5-gallon oil cans and well covered with cloth. It is occasionally examined to see that no lumps form and that no worms attack it. About 300 plants are considered necessary for one quart bottle of good seed. The coolie is paid from $7.20 to $8 per thousand for the plants.

CUTTING AND HOUSING.

Formerly the entire stalk of tobacco was cut and brought to the drying shed by the coolie in a conveyance called "pekoelan," a rude sled. About forty-five or fifty plants can be placed upon this conveyance. The coolie cuts the plants off with a knife in a slanting way 6 inches above the ground, and puts them carefully in the pekoelan. When he has cut a load he takes it to the drying shed. As all the leaves never ripen on the plant at the same time, much green tobacco is in this way carried to the shed.

Recently the system of priming has been adopted. In this method, instead of cutting the whole stalk, the leaves are taken off from the stalk and carried to the drying shed in baskets. Some growers prime off half the leaves in this way and then cut the balance of the stalk. Tobacco is never cut or primed when wet with rain or dew, as this causes the leaves to sunburn and little holes to form, which lowers the value of the leaf. The cut tobacco is very carefully kept from the ground and the pekoelan is covered while being hauled from the field to the drying shed.

The contract with the coolie ends with the delivery of the tobacco to the drying shed and its acceptance by the European assistant. After the main crop of tobacco has been cut, the best of the suckers, which have come out in the last few days before cutting, are allowed to grow and mature. These suckers are usually topped at about ten or even eight leaves, and the coolie receives for them, commonly, about half the rate of the other tobacco. They receive about $3.20 per thousand plants for the very best suckers, although occasionally $4.80 is given, but not often. The very small sucker plants are not accepted at all, but are thrown away. These plants always have to be kept separate. After the sucker crop has been secured the stalks of the tobacco plants still in the ground are taken out, root and all, by the coolies before they leave the field and go to the fermenting shed. This is done to prevent the growth of additional sucker crops, which would exhaust the soil without doing any good. The stalks of tobacco, after being stripped in the drying shed, are scattered over the field intended for the next year's crop.

When the tobacco is hauled in by the coolie he is supposed to put ten plants on the stick, as already explained, in such a way that it can be readily examined by the European assistant. The tobacco is purchased of the coolie at the rate of $6.40 per 1,000 plants for the best, and about 80 cents per 1,000 plants for the worst tobacco he delivers. He is therefore required to put up plants of the same kind together on the same stick.

Each coolie has a small book in which is entered the tobacco delivered by him. The assistant also keeps a book for the same purpose, with the number of his field, and sends in a report regularly to the manager, so that proper credit can be given to the coolie for the tobacco delivered.

The assistant also keeps a book showing the quantity of tobacco in each of the drying sheds, and in case of fire this book is the basis of settlement with the insurance company. It is necessary to have the sheds insured, at least while the tobacco is in them, as fire not only occurs occasionally from external causes, but the native battaks frequently set the sheds on fire for imagined wrongs or to secure redress of real grievances.

HANGING AND CURING.

When the coolie arrives at the shed with a load of tobacco he is met by a helper who has prepared the tobacco slats and has hanging on each of them ten little strings with a loop in each. Matting is spread on the ground and the plants are put on it. A plant is then placed in every loop, and ten plants are thus put on every stick.

The tobacco which has been accepted as satisfactory is hung for one day on the lower supports and is then removed to the top of the shed and the shed is filled from the top down. Green tobacco must never be hung under tobacco which is already half cured. The smaller plants are put up in the top of the shed, so far as possible, and the larger ones under them. A shed of the dimensions given will contain from 45,000 to 50,000 plants. A watchman sleeps in every shed and takes care of the opening and closing of the doors and windows for ventilation under instructions from the European assistant.

Light colors are much in demand at the present time, and for that reason in clear and warm weather all the doors and windows of the shed are kept open in order to get all the light and air possible. As a rule the doors and windows are not opened until after 8.30 or 9 o'clock in the morning, as there is much dew and moisture in the air during the night and early morning. At first they are only opened a little, as the green tobacco must not yellow too quickly. With strong, heavy winds everything is kept tightly closed. This is a matter of experience, and no rules can be given for the ventilation of the barn.

As a rule, the tobacco is cured in from four to five weeks and is ready to be stripped and bundled.

Occasionally during continuous wet weather it is necessary to use fire in the shed. It is, of course, better not to do this, but if it is necessary the following rules are adhered to: In the first place a fire must never be used which gives any smoke, because the odor will settle in the tobacco and never leave it. In firing everything must be closed and only perfectly dry wood can be used. Two sticks are put together with the ends against each other and lighted. The tobacco immediately over the fire must be pushed aside, so as not to allow it to come too close. A hole is made about 3 feet square and about 1¼ feet deep, in order to get a good draft. The fire is started at sundown and put out about 9 o'clock on the following morning, when the windows can be opened. The fire is put out by pulling the sticks away from each other and covering with sand. Water is never used for this purpose, as it might injure the leaf. The one thing that is needed is the heat of the fire, and no smoke nor steam must be allowed.

STRIPPING AND BUNDLING.

The tobacco is stripped on a little platform about 12 feet square in the drying shed. The bottom and top leaves of the stalk are kept separate. These are again divided into ragged and those which have holes in them and those which are black and heavily speckled. These four kinds are put together in separate bundles of about 50 leaves each. They are tied with the same string with which the tobacco was hung up in the first place. This stripping is done early in the morning.

The bundles are brought to the fermenting shed in baskets. No care is taken to separate the leaves into lengths, except that in a general way there should not be too great a difference between the length of the leaves in the same bundle. The baskets for carrying the bundles are about 4 feet in diameter and about 2 feet high. They are lined with matting and have strong handles. They will hold about 225 or 250 bundles. Care must be taken in packing the baskets not to pack the bundles in too tightly, and they should not come above the edge of the basket. They are then covered with matting and sent on an ox cart to the fermenting shed, each cart carrying two baskets. The baskets are numbered and the weight of each is put on the outside in plain letters.

The contract with the coolie ends, as already stated, with the delivery of the tobacco at the drying shed; all the work which he does after that he is paid for separately. In some plantations the stripping and bundling is done by the coolies, and in many of them by the Javanese women and children. The payment for stripping and bundling is 1 doewit per bundle. A doewit is one thousandth part of a Mexican dollar. The actual doewit piece is no longer in use, but it remains a basis for calculations. The 10-cent piece is in use, representing 100 doewits. With the Mexican dollars worth 80 cents, as it was when I was living in Sumatra, the payment for 100 bundles would be about 8 cents, American money.

FERMENTING.

Very much of the value of the Sumatra tobacco is dependent upon the infinite care that is taken throughout the whole period of its production. The minute care and incessant vigilance of the Chinese coolie, acting under the supervision of the manager and the assistants who represent the companies, can hardly be conceived by an American. Nowhere, however, is this care and thorough consideration of details shown more clearly than in the fermenting and sorting and grading.

The tobacco comes direct from the drying sheds to the one fermenting shed, which holds all the tobacco of the estate. It does not leave here until packed and ready for shipment to the European markets.

The fermentation has two purposes. The first is to insure the proper texture, glossy appearance, and color to the leaf. It brings out the characteristic properties of a wrapper leaf, which are hardly apparent when the leaf is cut in the field. It is furthermore necessary to press the tobacco into bales so that it can be shipped in compact form.

Formerly, when dark colors for cigar wrappers were in much favor by the dealers and manufacturers, the tobacco was worked up to a very high heat in the fermenting pile; but since lighter colors are more sought for the fermentation has to be done more slowly and not to such a high degree of heat as formerly.

It is impossible in the space of this article to describe the process of fermentation in all its details. Experience and judgment enter into the matter so largely that only one who has had this experience can appreciate the changes which are going on in the pile, and can judge of the necessary and further treatment.

The tobacco is put into piles of three kinds, the "quality" or top leaves, bottom leaves, and ragged tobacco. The piles are built up on matting. One row is spread on the matting, the bundles being placed close together with the heads in the same direction. At the corners the leaves are spread out like a fan. In this way layer after layer is put on until the pile is from 4 to 6 feet high. When a large or rather a high pile is to be made, hollow bamboo rods are inserted in the middle of the pile, in which a thermometer is placed at the end of a stick. The outer end of the bamboo has a plug of cotton, so that the temperature of the outside can not interfere with that of the inside. With smaller piles, and especially with trash and inferior tobaccos, simply a bamboo stick is inserted in the pile without a thermometer. The manager, on touching the stick when it is withdrawn, judges how warm the pile is inside. In still smaller piles the hand is simply put in between the bundles. When the temperature rises to about 100° F. the pile is taken down, the tobacco is given a chance to cool off slightly, and a new pile is put up in another place. Care is taken that bundles from the interior are placed on the outside, to give those which were formerly on the outside an equal chance of fermenting. The temperature gradually goes higher until it finally attains the temperature of about 130° F., when the fermentation is stopped. This maximum temperature must not be attained too quickly, as the quality of the leaf would suffer. No statement can be made as to how often the piles should be turned over, or when this should be done, as it depends upon the condition of the tobacco, especially as to how moist it was when put into the pile.

The so-called fat or "quality" tobacco, made up of leaves from the second half of the stalk—that is, from top leaves—has to be treated differently from the drier bottom leaves of the plant. It can not stand as much heat as the latter and must be fermented much more slowly and gradually. It will have to be torn down and rebuilt more often than the dry tobacco in order to obtain the light colors which are desired. In making up a pile of the finest grades of tobacco the bottom layers and the top of the pile are usually made of broken and inferior tobaccos, as the fermentation does not take place as readily here as on the inside of the pile.

The principal fermentation is thus done before the sorting, as after the sorting there are so many different grades which have to be kept separate that it is impossible to make as large a pile with many of them as would be desirable. Occasionally, however, these grades are refermented in order to improve the quality of the leaf.

SORTING.

The ragged leaves are usually assorted first of all when the coolie first comes in from the field, as there is little else for him to do at that time. The sorters sit on matting near the windows on both sides of the fermenting shed. They have in front of them wooden pins stuck on the ground in the shape of a half circle. These are for the different kinds of tobacco. The tobacco is usually divided, with infinite care and judgment, into the following kinds: Brown, dark gray, light gray, yellow, multicolored, coarse not speckled, slightly speckled, dark and brown slightly speckled, gray and light speckled all colors, little-broken dark and brown, little-broken gray and light, much-broken all colors, sweepings, and trash. Some of the estates have other divisions, and some of the kinds here mentioned are again subdivided, but these are about the most important.

The experienced sorter opens the bundle which he gets from the stick in front of him and commences to divide it, independently of lengths, into different kinds. Two or more coolies, that work in partnership with him, but who are not experienced enough to do the sorting, take the leaves out of the compartments between the wooden pins, and lay them down in such a way that the leaves of the same length come together. These leaves of the same length are then made up into bundles of from 35 to 40 leaves in each bundle, bound together with a piece of string, usually made of the inner bark of a tree. These bundles are kept together until they are inspected and received by one of the assistants. The inspection is very thorough, both as to color and length of leaf, and any leaves which should not be in the bundle are taken out. The coolie is then credited in the bundle book and paid at the rate of about 3 doewits for each bundle. He therefore has to sort out about 333 bundles to make a Mexican dollar. This money is divided by the sorter between himself and his helpers as they mutually agree.

All of the different kinds of tobacco are now put into separate piles, each pile having its mark on a little label. After this, the bundles in each pile are carefully sorted by lengths, and each kind is separately divided into bundles having leaves of the same length to be baled together. As each bundle already contains only leaves of uniform length, all the coolie has to do is to measure the whole bundle, and then keep the four different lengths together. These lengths are as follows: (1) From 16 inches up to 20 inches; (2) from 12 to 16 inches; (3) from 9 to 12 inches; and (4) from 6 to 9 inches. Before the tobacco is sorted into lengths it is occasionally put through a second fermentation, and in this case the temperature occasionally runs up as high as 150° F., and even higher, but this is not advisable in the production of light-colored wrappers.

In sorting as to length the Sumatra planter is inclined to be very liberal; that is, when a bundle is just long enough to go for second length he will take no chances, and will rather put it with the third than run the risk of criticism from the European dealers. Also, if the tobacco is all packed and a little tobacco left of two or three of the different grades, which would make together one bale, the planter puts on that bale the mark of the most inferior of the kinds, so that the buyer gets the benefit of the doubt in all cases. This is one reason why the Sumatra tobacco commands such a good price, as the purchaser can be sure that the contents of the bale have been very carefully assorted, and that it always conforms to what is written upon the outside of it.

BALING.

After the bundles are assorted into lengths the tobacco is pressed into bales of 80 kilograms, equal to 160 Amsterdam pounds and to 176 English pounds. The trade-mark chosen for the estate is then put upon the outside of the matting which covers the bale, and marked to indicate the grade and length of tobacco. The bale is made in the following way: A wooden or iron receptacle, consisting of four loose sides without cover, is put under the press. It is about 2½ feet square and something over 2 feet high, and goes in on rollers. The four sides are taken off when it stands under the press. Matting is put on to the bottom in such a way that it projects out on either side. Then the four sides are put up and filled with tobacco which has previously been carefully weighed out in baskets. The filling of the box with tobacco has to be done by experienced hands, and great care is taken to spread the leaves out uniformly in the bundles. Care is especially taken to spread them out at the corners in such a way that it will make a nice package with square corners. When the proper weight of tobacco is put in the whole is covered with matting which has previously been labeled with the estate's especial marks. The press is applied until the package has a thickness of about one foot. The iron cover to the press fits in the box so that it goes down without touching the sides. It frequently takes as many as twenty able-bodied men to press the cover down and squeeze the bale into the proper dimensions. When in this condition, the sides are removed and the matting of the top and bottom is pulled together and sewed on the four sides, and iron pins are put in to keep it in position. When thus fastened the pressure is removed and the package is rolled out. The matting is then strongly sewed with stout twine, and then the iron pins which secured it temporarily are taken out. The bale is then marked as to its grade and length and is ready for shipping.

The coolies are paid 3 doewits per bale, making it necessary, in order to earn a Mexican dollar, to make 333 bales per day, which they never do. As a matter of fact, it takes from 16 to 20 men to put up 120 bales per day, and they consider that they have worked pretty hard in doing this. Most of the coolies are already at work in the fields for the next crop before the tobacco is all baled and ready to be shipped. Bales are transported either by river or railroad to the seaports where they are to be put on steamers and sent to Europe. Nearly all of it is sent to the Dutch markets, most of it going to Amsterdam.

PRICES AND PROFITS.

The statistics given in the tables in the appendix to this bulletin show something of the enormous profits which have been made by some of the companies. As a rule, the tobacco produced in Deli and Langkat brings the best prices of any from the east coast of Sumatra. For example, the Deli tobacco of the crop of 1893 brought an average price of approximately 64 cents per pound, American money; Langkat, 62 cents; Asahan, 35 cents; Serdang, 44 cents; Batoe Bahara, only 30 cents per English pound. The prices quoted in the tables are, of course, the average price of the whole crop, which consists of all grades and kinds of tobacco. In all crops some of the small and inferior tobacco brings only 5 or 6 cents per pound. With the 1892 crop some of the third length, measuring from 9 to 12 inches, was sold for as much as $1.55 per pound. Frequently the first-class wrapper leaf will sell for as much as $2.40 per pound, and finer grades for much more than this.

It will be seen from the tables that some of the companies have paid during their existence and are still paying enormous dividends. It is true that their quotations are high and the shares sell at a big premium, but even granting this the profits are enormous. The stock of the Maatschappij Arendsburg, which has paid the highest dividends of all during its existence, was quoted in 1895 at 730. It was then paying a dividend of 111, making even at that quotation an interest of more than 15 per cent on the investment, earning the original capital every year.

These dividends and the enormous profits made by some of the companies induced a great many people to go into the tobacco business, and company after company came into existence. Unfortunately, however, the best soil is limited to a small area, and most of this had been already taken up. The newcomers, therefore, took up land wherever it could be obtained, so long as it was on the east coast of Sumatra. Besides this, many people who knew little or nothing about tobacco commenced planting it, attracted by the dividends. The result could readily have been foreseen. They produced, indeed, Sumatra tobacco, but of such an inferior quality, of a bitter, oily taste, and with a poor "burn," that prices went down rapidly until, when the crop of 1890 was sold for 29 cents per pound, American money, the crash came. This crop was 50,000 bales larger than the crop of 1889. The cost of the production per pound of this tobacco is believed to be from 32 to 36 cents per English pound in American money, and as a consequence no dividends were declared at that time. It is true that there were other reasons which forced the price down. Among others, the United States had supplied itself abundantly the year before, in anticipation of the new tariff, and bought only 11,000 bales, where it had purchased 48,182 bales the year before, and where it purchased 32,926 bales the next year.

Several of the new companies had to go into liquidation immediately and many estates were closed. The average price of the next crop, although hampered by the inferior tobacco remaining in the hands of the Amsterdam importers, showed some improvement and went up to 34 cents per pound, American money. The average price for the 1892 crop rose to 45 cents, and for the next crop to 52 cents, after which it came down again to 33 cents for the 1895 crop.

It is clear from this that the market must not be overstocked, and in the second place that no inferior tobacco can be put upon the market without injuring the price of all grades. The returns show that the Sumatra tobacco imported into the United States must be of the very best quality, judging by the prices paid for it.

GROWING SUMATRA TOBACCO IN FLORIDA.

My experience in this country has convinced me that a very good type of Sumatra tobacco is being successfully raised in some of the counties of Florida. If this continues of the same good quality and is well and conscientiously prepared for the market, there is certainly a large market here in the United States for a great deal more than is at present produced. If it will take the place of the imported Sumatra the manufacturer will save an enormous amount in duty alone, and will probably be very willing to take the tobacco at a good price. It must not be forgotten, however, that one of the great values of the Sumatra tobacco, and the thing which contributes more than anything else to give it the great value placed upon it by the manufacturers, is the fine texture of the leaf, which can only be attained upon certain soils; other things worth mention are the uniform color, which is brought out in the fermentation; and the very great pains taken to assort it into grades of uniform color and length, so that a manufacturer may be assured in buying a bale that he secures just what is marked on it.

APPENDIX.

Production of Sumatra tobacco from 1864-1896.

[**The yield is given in bales of about 80 kilos each (about 176 pounds) and the price is for one-half kilo in cents (Holland). One-half kilo 1.1 pounds, and 100 cents (Holland) = 1 guilder = 40 cents of United States. The price noted is the average for the crop.**]

Year.	Production.	Price, one-half kilo.	Total value of crop.
	Bales.	*Cents.*	*Guilders.*
1864	50	48	4,000
1865	189	149	40,000
1866	159	121	30,000
1867	210	73	20,000
1868	890	142	200,000
1869	1,381	129	250,000
1870	3,114	122	500,000
1871	8,922	137	750,000
1872	6,409	132	1,000,000
1873	9,238	182	2,500,000
1874	12,805	150	2,850,000
1875	15,355	170	3,900,000
1876	29,034	152	6,500,000
1877	36,517	126	6,800,000
1878	48,545	126	9,200,000
1879	57,596	117	10,350,000
1880	64,965	112½	11,250,000
1881	82,356	115	14,750,000
1882	102,047	137½	21,500,000
1883	93,532	134	19,150,000
1884	125,496	144	27,550,000
1885	124,911	141½	26,976,000
1886	139,512	154	32,600,000
1887	144,577	121	26,650,000
1888	182,284	128½	35,500,000
1889	184,322	146	40,600,000
1890	236,323	72½	26,000,000
1891	225,629	91½	31,400,000
1892	144,689	126	26,700,000
1893	169,526	144	37,600,000
1894	193,334	119	35,000,000
1895	204,647	90	28,350,000
1896	191,185	111	32,400,000
	2,834,839	119½	518,870,000

Sumatra tobacco imported into the United States.

Year.	Imports.	Total value, exclusive of duty.
	Bales.[1]	
1876	Sample lot.	$260.00
1877	Sample lot.	30.00
1878	...	...
1879	...	...
1880	752	87,807.00
1881	2,691	300,192.17
1882	6,780	780.016.55
1883	6,039	2,373,839.29
1884	10,810	1,684,694.13
1885	24,348	3.504,660.42
1886	22,243	3,245,826.77
1887	35,199	5,825,826.14
1888	15,321	3,827,980.30
1889	42,397	6,478,195.78
1890	48,182	8,251,929.42
1891	11,645	873,246.56
1892	32,926	4,573,702.06
1893	18,418	3,711,406.52
1894	35,022	7,517,029.19

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[1] Bale = 80 kilos.

Financial statement of the principal tobacco companies.

Name of company.	Organized.	Capital.	Quotation at issue.	Dividends, 1886-1895.			Quotation, 1888-1895.	
				Number paid.	Lowest.	Highest.	Lowest.	Highest.
					Per ct.	*Per ct.*		
American Deli Co	1894	(?)	....	8	10	95	170	640
Amsterdam Deli Compagnie	1879	G 1,000,000	100	....	....	....	....	....
Amsterdam Sumatra Cultuur Maatschappij	1894	G 800,000	....	....	....	....	....	....
Asahan Tabak Maatschappij	1889	G 800,000	....	....	....	....	....	....
British Deli and Langkat Tobacco Co. (Limited)	1889	£320,000	....	8	6	15	....	....
Deli Batavia Maatschappij	1875	G 1,000,000	100	8	10	62½	210	482
Deli Cultuur Maatschappij	1894	G 2,000,000	115	....	....	....	119	136
Deli Langkat Tabak Maatschappij	1886	G 1,000,000	100	5	8	25½	28	300
Deli Maatschappij	1869	G 8,000,000	{ 100 200 }	9	29¾	109	334	860
Deli Tabak Maatschappij	1893	G 1,350,000	112	3	7½	8¾	91	133
Langkat Cultuur Maatschappij	1895	G 1,200,000	110	1	....	9	91½	104
Langkat Tabak Maatschappij	1894	G 2,100,000	105	1	....	4	69	105
Medan Tabak Maatschappij	1890	G 4,000,000	{ 125 200 }	2	10	12½	125	196
Nederlandsche Asahan Tabak Maatschappij	1891	G 3,500,000	122	....	....	....	49	125
Padang Tabak Maatschappij	1895	G 600,000	125	1	....	6	100	118
Paya Janbu Estates Co. (Limited)	1881	(?)	....	....	....	....	....	....
Ramoenia Cultuur Maatschappij	1896	G 750,000	....	1	....	6	....	....
Rotterdam Deli Maatschappij	1888	G 1,200,000	100	2	11	12	73	160
Senembah Maatschappij	1889	G 1,500,000	200	5	6½	60	135	370
Serdang Tabak Maatschappij	1894	G 1,700,000	100	2	6	8½	91	108
Shanghai Sumatra Tobacco Co. (Limited)	1883	M $130,000	....	(?)	(?)	(?)	....	....
Sumatra Cultuur Maatschappij	1892	G 1,000,000	....	1	....	6	....	....
Sumatra Tabak Gesellschaft "Tandjong Kassan"	1888	F 450,000	....	2	10	19	....	....
Sumatra Tobacco Plantations Co. (Limited)	1888	£60,000	....	2	10	19½	....	....
Tabak Maatschappij "Arendsburg"	1877	G 1,000,000	100	7	14	152	400	1,020
Tabak Maatschappij "Franco Deli"	1895	G 3,000,000	110	....	....	....	70	107
Tabak Maatschappij Tjinta Radja	1892	F 800,000	....	(?)	(?)	(?)	....	....
United Langkat Plantations Co. (Limited)	1889	£450,000	....	5	8	30	....	....

G = guilder, or about 40 cents United States money.
£ = pound sterling, or about $4.86.
F = franc, or about 19 cents.
M $ = Mexican dollar, or about 44 cents United States money.

Crop statistics of the principal companies operating in 1896.

Name of company.	Number of estates.	District.	Total acreage.	Bales, 1896.	Prices, Dutch money.			
					1893.	1894.	1895.	1896.
					Cents.	*Cents.*	*Cents.*	*Cents.*
American Deli Co	1	Padang	(?)	917	......	......	47	73
Amsterdam Deli Compagnie.	5	Deli	10,100	8,191	201	165	100	133
Amsterdam Sumatra Cultuur Maatschappij.	3	Padang and Bedagei	8,080	2,407	......	......	75	81
Asahan Tabak Maatschappij.	1	Bilah	5,000	....	70	32	Failed.	
British Deli and Langkat Tobacco Co. (Limited).	5	Deli and Langkat	10,600	6,726	112	111	78	110
Deli Batavia Maatschappij.	5	Deli	11,000	9,906	148	152	101	115
Deli Cultuur Maatschappij.	5	Deli	5,800	7,325	109	79	92	106
Deli Langkat Tabak Maatschappij.	1	Deli	2,400	2,218	162	125	97	141
Deli Maatschappij	21	Deli and Langkat	82,400	45,811	156	124	100	125
Deli Tabak Maatschappij	2	Bedagei	8,000	3,139	92	76	71	77
Langkat Cultuur Maatschappij.	1	Langkat	4,500	2,008	146	146	74	95
Langkat Tabak Maatschappij.	3	Langkat	4,200	4,224	135	107	114	144

Crop statistics of the principal companies operating in 1896—Continued.

Name of company.	Number of estates.	District.	Total acreage.	Bales, 1896.	Prices, Dutch money.			
					1893.	1894.	1895.	1896.
					Cents.	*Cents.*	*Cents.*	*Cents.*
Medan Tabak Maatschappij	2	Deli and Langkat	10,477	3,342	133	120	93	135
Nederlandsche Asahan Tabak Maatschappij.	6	Asahan	28,500	6,372	92	91	59	111
Padang Tabak Maatschappij.	1	Padang	5,000	1,773	......	126	94	97
Paya Jambu Estates Co. (Limited).	1	Langkat	2,800	1,185	123	164	83	139
Ramoenia Cultuur Maatschappij.	2	Serdang and Deli	3,300	1,997	......	......	93	105
Rotterdam Deli Maatschappij.	4	Deli and Padang	6,100	5,162	121	104	76	71
Senembah Maatschappij	6	Serdang and Deli	47,836	12,645	136	101	106	122
Serdang Tabak Maatschappij.	3	Serdang	19,450	2,244	88	87	77	104
Shanghai Sumatra Tobacco Co. (Limited).	1	Langkat	1,500	3,008	130	135	100	132
Sumatra Cultuur Maatschappij.	1	Serdang	4,000	1,269	......	60	74	96
Sumatra Tabak Gesellschaft "Tandjong Kassan."	1	Batoe Bahara	3,000	1,583	89	65	53	52
Sumatra Tobacco Plantations Co. (Limited).	1	Serdang	2,500	1,071	......	87	69	73
Tabak Maatschappij "Arendsburg"	5	Deli	14,500	10,269	174	147	84	113
Tabak Maatschappij "Franco Deli."	3	Deli	5,208	4,852	138	114	74	80
Tabak Maatschappij "Tjinta Radja."	1	Langkat	3,000	2,753	205	125	103	123
United Langkat Plantations Co. (Limited).	3	Langkat	9,000	6,711	161	172	114	155
Average for incorporated companies.	......	......	......	160,207	145	121	92	116
Private plantations	......	......	......	30,978	140	110	78	85
General average	......	......	......	191,185	144	119	90	111

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the assumption of a perfect combustion of the glucose. There are organic acids present in the original tobacco leaf, such as citric, malic, and oxalic acids, in the form of neutral salts. A part of these acids may be changed and destroyed in the fermentation process, while other acids may be formed by the changes the glucose undergoes.[1] The nicotine is bound to organic acids and is not present in the free state; besides, most of the ammonia formed is in combination with organic acids, but a part of it is easily liberated by boiling the aqueous extract of the fermented tobacco. These vapors have a strong alkaline reaction and an ammoniacal odor, and are due either to the volatilization of some ammonium carbonate or to the dissociation of a neutral ammonium salt of a bibasic acid.

Tannin.—The amount of tannin, like that of nicotine, also decreases in fermentation. It varies from 0.3 to 2.3 per cent in commercial tobaccos. The Florida tobacco of 1898 contained only traces of tannin after the fermentation was over. The amount of fatty matter, or, more correctly speaking, of substances soluble in ether, was found by Jenkins[2] to decrease in fermentation from 3.5 to 2.8 per cent of the dry matter. Behrens observed in one case a decrease from 9.14 per cent in the cured to 8.34 per cent in the fermented leaf. The amount of such fatty substances was found to vary in different samples from 1.8 to 10 per cent and in some cases even more. The decrease of fatty matter during fermentation is probably due to the volatilization of a volatile ethereal oil. It is certainly very improbable that some true fat was oxidized to carbonic acid and water. Little attention has been given thus far to the small amount of resins in tobacco.

Fiber.—In regard to the fiber, Jenkins determined its amount in Connecticut tobacco as ranging from 13 to 14 per cent. Fesca and Jmai found the range in Japanese tobacco to be from 13 to 15 per cent. Only the ribs contained more—from 22 to 24 per cent.[3]

Ashes.—The amount of mineral matter is subject to very great variation, namely, from 10 to 27 per cent.

Nitrate.—A question of special interest is the fate of the nitric acid probably present exclusively as potassium nitrate in fresh leaves. Some authors believe that nitrification goes on during the fermentation process, which would lead to an increase of nitrate in the fermented leaf. This, however, has never been proved by chemical analysis and is indeed highly improbable. Other investigators, for instance, Jenkins, have proved that the nitrate content undergoes only an insignificant decrease,[1] and still others, as Fesca and Behrens, assert that the nitric acid disappears completely, probably by reduction. These contradicting statements may be due to the great variations occurring in the nitrate percentage. A small amount might disappear completely while a larger amount decreases but little, although in both cases the absolute amount disappearing may be the same.

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[1] The precipitate obtained by copper acetate from a hot, aqueous extract of fermented tobacco contains, among other things, some succinic acid. The writer did not recognize butyric acid among the volatile acids in Florida tobacco, but acetic acid was present.

[2] Conn. Agr. Expt. Sta., Ann. Rept. 1890. Correct comparison is, however, possible only in calculating for a constant, e. g., cellulose.

[3] There are still certain substances in the fermented tobacco which thus far could not be characterized. Some analyses show from 1.7 to 18.9 per cent of nitrogenous extractive matter and from 8.6 to 16.7 per cent of indefinite insoluble matter. There exists great difficulty in isolating certain compounds from these mixtures.

The writer examined, qualitatively, both fresh and fermented leaves from the same farm near Quincy, Fla., and found a moderate amount of nitrate in both. The samples of tobacco examined by Jenkins contained from 1.89 to 2.59 per cent of nitric acid (N_2O_5) at a water content of 23.5 to 27.5 per cent, while Behrens's samples contained only 0.2 per cent of this acid in the dry matter. From the disappearance of such a small amount of nitric acid, it can not be inferred that larger quantities would disappear entirely. In one of Jenkins's samples the amount of nitric acid diminished from 2.59 to 2.35, that is, a diminution corresponding to 0.4 per cent calculated for dry matter of the wrapper leaves. Dambergis observed variations of nitric acid in Greek tobacco of commerce of from 0.5 to 3.37 per cent of the dry matter. Not only the mode of manuring, but also the nature of the soil and the weather, influence the nitrate content of the plants, hence large differences can not be a matter of surprise.

The principal changes which take place during the sweating or fermentation process, as found by various investigators, may be summed up as follows:

(1) Decrease of nicotine.
(2) Increase of ammonia.
(3) Increase of alkaline reaction.
(4) Disappearance of sugar.
(5) Decrease of nitrate.
(6) Improvement of flavor and aroma.

THE COLD SWEAT, AGING, OR AFTER-FERMENTATION.

The cold sweat which unfermented tobacco undergoes, and which corresponds with the aging of wines, may be intentionally carried on for as long as two years, where the main fermentation process has to be shortened for any reason or is not thoroughly completed. Fully and perfectly fermented leaves do not require this cold sweat, and the manufacturers of a good product prevent after-fermentation by giving such a degree of dryness in packing that further changes are stopped, as after-fermentation might finally lead to great differences in the product, which should be uniform. The interior of the piles or cases would naturally become warmer, and the leaves would change more than those near the sides. In many cases, however, a further change is found necessary, and slightly moistened sponges are placed in the cases with the tobacco in order to maintain a certain degree of moisture. After-fermentation carried on for too long a time might finally destroy all good qualities by further oxidations.

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[1] Conn. Expt. Sta., Ann. Rept. 1892. To Jenkins belongs the credit of having first compared the fermented with the unfermented leaf in regard to the chemical changes.

THE PETUNING OF THE TOBACCO.

The petuning is an operation first practiced in Cuba, and consists in spraying a liquid on the leaves during or after the sweating process. The fillers only, and not the wrappers, are petuned, the intention being to give them a darker color, an improved flavor, and the appearance and character of a strong tobacco. The composition of the petuning liquid used in Cuba is kept secret, and indeed each planter claims to have something known only to himself. It is generally believed that one method of preparing the petuning fluid is by pouring organic fluids yielding ammonium carbonate over crushed tobacco stems, and letting this mixture digest. This liquid is, of course, very liable to putrefy, and consequently a most luxuriant growth of bacteria may be expected within a few days in the warm climate of Cuba. It is no wonder then that on the surface of Havana tobacco various bacteria are found, although it may be doubted whether they live long on these fermenting leaves. The ammonium carbonate contained in the petuning liquids increases the alkaline reaction already present in the fermenting leaf, and thus supports the energy of the oxidizing process which brings on the dark color frequently desired for the filler leaves.

One might naturally suppose that the ammonium carbonate would dissolve some resinous matter from the stems which would lead to an improvement of the aroma of the fillers if the hypothesis is correct that this aroma depends to a great extent upon the resin content of the tobacco plant, but this the writer holds is doubtful.

Petuning is practiced in some parts of the United States also, but the opinion of tobacco manufacturers whom the writer has consulted upon the subject is that the effect of the treatment is overrated. By the most intelligent growers a hot solution of ammonium carbonate is left to act upon the stems of Havana tobacco. This extract is prepared anew every day for use, which easily accounts for the fact that the tobacco leaves thus treated do not show any bacterial flora on their surface. The petuning liquid often has a different composition. The tobacco stems are extracted with water containing rum, molasses, or sour wine, consequently these liquids may swarm with bacteria after they stand for a while. The molasses is supposed to disguise the bitter taste derived from the stems.

Related to the petuning is the so-called "conditioning" of the tobacco, consisting in the spraying with a 2 per cent solution of glycerin. This operation is carried on only with chewing, plug, and cigarette tobaccos, and is intended to keep these products moist and pliable, as perfectly dry tobacco would easily crumble to a powder.

THE BACTERIAL FERMENTATION THEORY OF SUCHSLAND.

It has long been recognized that the main feature of the processes going on in the sweating, or the so-called fermentation, of tobacco consists in oxidations. These are accompanied by certain decompositions liberating ammonia, and are the source of the striking development of heat in the fermenting piles. Now, what is the cause of these powerful oxidations? Nessler, as well as Schlösing, asserts that it is merely the common oxygen of the air that attacks certain compounds in the cells with great ease, no other cause being required. Schlösing admits bacterial action only for initiating the elevation of temperature, but not for the main processes later on. On the other hand, Suchsland attributes all the oxidations and the development of heat to the action of certain bacteria, which are specific for different kinds of tobacco and which impart to each of them a specific aroma.

Nessler's and Schlösing's views must assume substances of an unusual affinity for oxygen, if the rather indifferent atmospheric ogygen could exert such a powerful result without the intervention of any activifying principle, hence Suchsland's view seemed more probable and soon found many followers. He prepared pure cultures of microbes found upon different kinds of tobacco,[1] and by transferring those obtained from Havana tobacco to German tobacco he expected to develop the Havana aroma in the German tobacco, but thus far no new developments have startled tobacco growers. Davalos described mold fungi and microbes occurring upon fermenting tobacco leaves in Havana, but without proving their importance for the fermentation process (see Petuning). Vernhout observed only one kind of bacterium upon fermented tobacco leaves. This developed at 50° C. (122° F.) upon agar plates, and was a thermophile kind of the group of *Bacillus subtilis.*[2] It developed also in decoctions of tobacco and was capable of decomposing proteids with development of ammonia. Vernhout, however, leaves it entirely undecided as to whether this microbe plays any important part in the fermentation process. Also Koning[3] described several kinds of bacteria from fermenting tobacco leaves which he found to be identical with those occurring also on the green tobacco leaves. Besides the known bacteria, *B. mycoides* and *B. subtilis*, he described five aerobic new kinds, called *B. tobacci* Nos. I, II, III, IV, and V, of which *B. tobacci* III seemed to have most influence on the aroma. These statements may well be doubted, as a direct microscopical investigation of the surface of the fermenting leaves is wanting.

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[1] Ber. d. Deut. Bot. Ges., Vol. IX, 1891.

[2] How some authors can assert that the fermentation is caused by *anaerobic* bacteria when it is a known fact that the most important changes going on consist of *oxidations* remains difficult to understand.

[3] Zeitschr. für Unters. der Nahrungs and Genussmittel, 1898, No. 3. It may also be mentioned that this author claims to have discovered the bacteria causing the mosaic disease of tobacco, while the most careful researches of Bejerinck have proved that bacteria are not the cause of it.

The writer has repeatedly tried to scrape off bacteria from the surface of freshly fermented Florida tobacco leaves, but has searched in vain with the highest magnifying power for the millions of microbes naturally to be expected if they really play a part in raising the temperature of the fermenting heap and bringing on powerful chemical changes. These *fermenting* leaves are, however, exceedingly *smooth* and *clean*, and the scrapings obtained from them consist almost exclusively of particles of the epidermis. Only here and there, by application of staining methods, some small globules become visible which might represent spores or cocci. Certainly so few microbes could never be held responsible for the action in the fermenting heap, but, on the contrary, colonies of luxuriant growth, as seen spreading profusely upon potatoes or agar, ought to be expected. It is very instructive that Behrens in his attempt to isolate bacteria from the surface of cured tobacco leaves, obtained two spore-forming microbes, *Bacillus subtilis* and a *Clostridium*. One can not suppress the supposition that both kinds have been present only as spores and as such would remain inactive during the so-called fermentation process, as there is not sufficient water to bring on their germination.

It is evident that for the proper examination of fermenting tobacco leaves one must *avoid petuned* leaves, upon which all kinds of microbes can be found when a putrefying petuning liquid is applied. But this liquid is not at all essential for starting the fermentation process. The fermenting Florida tobacco leaves the writer had under examination were not petuned, and he most emphatically declares (1) that there are no bacteria in the cells of the tobacco leaf, and (2) that the surface is remarkably clean and is not covered by a bacterial coating. This observation was made also by Mr. Albert F. Woods, of the Division of Vegetable Physiology and Pathology, two years ago in his study of spots on fermented leaves.

The chief object and pride of the tobacco manufacturer is to produce a cigar leaf of faultless quality. This would be impossible were bacteria to develop their activity promiscuously on the surface, as their first step would be to reach the nourishing material in the interior of the cells, otherwise they would be incapable of multiplying except for a short time. In gaining entrance to the cells the cellulose walls would have to yield, or, in other words, the surface of the leaves would be attacked.

We have here quite a different case from that of the fermentation of sauerkraut, which contains over 92 per cent of water and a proportion of cellulose to water as 1 to 62. In the fermenting tobacco leaf the amount of water is generally below 25 per cent and the proportion of cellulose to water is generally less than 1 to 1.5. In fact, the water present merely suffices to impregnate the cellulose walls and contents of the cells, and is entirely insufficient to bring organic matter from the interior of the cells to the surface, where bacteria might feed upon it.

It is indeed a matter of interest to observe how the tobacco leaf becomes less fit to support bacterial life after being cured and fermented. While the expressed juice of the fresh tobacco leaf exposed to the air at the ordinary temperature teems with myriads of bacteria within twenty-four hours, the equally concentrated extract of cured or fermented leaves will remain perfectly clear for many days.[1] On the fresh tobacco leaf, as everywhere in nature, numerous kinds of microbes occur, but these seem to die off when cured leaves are fermented, as will be seen from the following experiment by the writer with Florida tobacco leaves: Into about 15 cc. of sterilized beef broth, contained in three test tubes closed with cotton plugs, were introduced, with all necessary precautions, (1) a small scrap of fresh leaf, (2) a small scrap of cured leaf which had been packed two months waiting fermentation, and (3) a scrap of fermented leaf. The tubes were kept at from 15° to 18° C. for several days. No. 1 was turbid after one day, when a scum formed and the liquid became very turbid; the liquid swarmed with bacteria, thick and thin rods and cocci being revealed by the microscope. Nos. 2 and 3 remained perfectly clear, and after eight days merely a trace of flocculi was seen at the bottom, in which a few cocci (Sarcina (?)) could be recognized. Indeed, the juice of the fermented tobacco leaf acts as an antiseptic upon the ordinary bacteria of putrefaction. When a slice of meat is wrapped in a fresh tobacco leaf, and another in a moistened, fermented tobacco leaf, it will be seen after a few days that the former slice is rotten and the latter not.[2] This property of course disappears upon considerable dilution of the juice, as will be seen from the following experiments: Ten grams of fermented and well-dried tobacco leaf were pulverized and extracted with 250 cc. of boiling water. A part of the filtrate received an addition of sugar and another part an addition of peptone. The well-sterilized flasks were infected with small chips of fermented tobacco leaf and some of them kept at 50° C. (122° F.) for three days, and some at from 18 to 20° C. (64.4° to 68° F.). There was more or less development in all the flasks, but further tests, as the inoculation in peptone solution or on potatoes, revealed as the only organism a bacillus resembling *B. subtilis*. The development of the colonies, the mode of growth on the surface of peptone solution and on potato, and the spore-forming threads left no doubt on this point. This result is then in full accordance with the observations of others—that is, that this bacillus can be cultivated from fermented tobacco leaves. But as the most careful searching of the surface of the fermented leaves for the bacillus itself proved vain, it must be assumed that it exists on these leaves only in the form of spores.

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[1] It may be mentioned, however, that a diluted (1 per cent) solution of a neutral nicotine salt will permit a bacterial growth.

[2] Southern manufacturers assert that the workmen in tobacco factories better resist epidemics than those not so employed.

When by accident leaves are too much moistened before they are subjected to the sweating, they will soon lose their coherence and show spots and finally holes. The water content, the writer found, in one such case amounted to 36 per cent. Here, then, is a true action of bacteria, which can develop under these conditions, as the high percentage of water admits an abundant exit of organic compounds from the interior of the cells to the surface and the formation of a diluted solution. Now, it is the experience of every tobacco manufacturer that the product will invariably spoil when the water content is increased to such a point as to permit an exit of soluble organic compounds from the cells. Here, then, begins the parallelism to the fermentation of sauerkraut or ensilage, but not before. The objection that certain kinds of thermophylic bacteria might be capable of developing on the leaves in the presence of a smaller percentage of water can not be sustained, as they require liquid food as well.[1] And how will they reach the interior of the cells without eating through the cellular walls, that is, without ruining the product? The claim that it is not the bacteria but the enzyms they produce that enter can not hold good, as the latter must be dissolved before they can migrate into the interior of the cells, and hence a water increase is again required. The conclusion that must invariably be reached, therefore, is that the bacteria found upon the fermenting tobacco leaves do not participate in any way in the fermentation process, but that they are accidentally present and probably only in the form of spores.

THE OXIDIZING AGENCY IN THE FERMENTING TOBACCO LEAF.

After showing that the bacterial theory of Suchsland is erroneous, as there exists no bacterial coating on the leaves, the question naturally presents itself, what is the cause of the oxidizing action? The assumption of Nessler and of Schlösing that the contact with the atmospheric oxygen would suffice can not be correct for the following reasons: (1) The substances undergoing oxidation (tannin, nicotine, etc.) do not show such powerful affinities for oxygen as to account for the considerable development of heat; and (2) neither curing nor fermentation sets in when the fresh leaves are killed by direct application of steam, although those organic matters which become oxidized in the fermentation process are not changed at all thereby.

Neither the tannin nor the nicotine of the leaves can be energetically oxidized by the molecular oxygen of the air without assistance or stimulation of some sort. In the same way dilute alcohol can not be oxidized into acetic acid by the common molecular oxygen of the air except through the intervention of certain bacteria or platinum black.[2]

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[1] Cohn made investigations on the growth of thermogenic micrococci in the refuse from the cotton purifier. However, he had to add a fair percentage of water to start the development.

[2] Müller-Thurgau declares (l. c., p. 508) that "In the beginning of the curing the changes consist in an increased respiration, but later on, after the cells have died, in other ('*anderweitigen*') oxidation processes," but he gives no explanation of the cause of these latter ones.

The oxidations in the treatment of tobacco commence with the curing process and are continued in the fermenting process. In the latter case, but not in the former, the aid of bacteria has been invoked for explanation. But when oxidations can go on in the *curing* without bacterial aid, even after the death of the cells, then it might be supposed that the same cause would also lead to oxidation later on during the fermenting process. Now, what is the true cause of these phenomena? There remains, in fact, as the only explanation the writer's suggestion that an *oxidizing enzym* is the final cause of the energetic oxidizing action after death of the cells as it is capable of instigating certain compounds to take up the molecular oxygen of the air.

The formation of enzyms is a physiological necessity for every living organism. Various enzyms come into action especially in the development of shoots, as well as in the inanition state of the plants. Green plants, as well as lower fungi, prepare enzyms, which may act on protein, polyanhydrids of glucoses, glucosides, or fat, splitting or dissolving these bodies and thus making them more easily accessible to the protoplasm.[1] The list of enzyms has been enlarged in recent years by the oxidizing enzyms or the oxidases, which were brought to our knowledge first by French savants, as Gabriel Bertrand, Bourquelot, Gouirand, Cazeneuve, and others. The most thorough investigations on this subject are those by Professor Bertrand, who has shown their wide distribution through the vegetable kingdom.[2]

The best reaction for oxidizing enzyms consists in the production of a blue color with the tincture of guaiac, which reaction can be obtained with various vegetable objects. This blue coloration is produced in many cases only upon addition of peroxide of hydrogen, in which case it was formerly considered as a reaction upon diastase. While the crude diastase of malt gives this blue reaction in a very marked degree, the diastase of certain fungi (*Aspergillus oryzæ*) will, as the writer long since ascertained, yield this reaction either only slightly or not at all, although this diastase has very energetic qualities and produces glucose from starch. Raciborski and other authors also have proved that this blue reaction is not characteristic of pure diastase, but only of an admixture of an oxidase.

The brown, black, or reddish coloration of freshly prepared juices of potatoes, turnips, etc., setting in when exposed to the air, the brown color of the falling leaves in autumn, and similar phenomena are generally due to the action of the oxidases. The oxidation of tannin by oxidases plays an important part in certain fruits ripening or overripe.

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[1] A trophic irritation is exerted when rapidly developing cells or cells in a state of inanition require nourishment, and this stimulus leads to the production of enzyms by the nuclei—an interesting case of physiological adaptation. Well-nourished cells killed in the full vigor of life often give only slight indications of amylolytic and proteolytic enzyms.

[2] Further contributions have been published by Grüss and by Raciborski (Ber. d. Deut. Bot. Ges., Vol. XVI, Nos. 3 and 5, 1898).

The blackening of bananas some time after they are gathered and the brown color on the surface of a slice of apple may also be mentioned as due to these agents.

Oxidizing enzyms also occur in animal organisms, as the investigations of Pieri, Abelous, Bougault, Salkowski, Yamagiva, Linossier, Jaquet, and Schmiedeberg have revealed. Such enzyms were found in various organs, and are capable of easily oxidizing not only guaiac tincture,[1] but also certain aldehydes, such as salicylic aldehyde. Spitzer has determined the amount of oxygen liberated by different organs from peroxide of hydrogen, and has observed that various poisons, such as potassium cyanide, hydroxylamin, etc., small quantities of acids and alkalies, and a temperature of about 70° C. (158° F.) destroy or diminish the oxidizing action of this animal enzym. Water extracts the enzym from the organs, and highly diluted acids, cautiously added, precipitate it with all its original properties. (Abelous could, however, prepare clear solutions only by application of potassium nitrate.) It has the character of a nucleo-proteid and contains from 0.19 to 0.23 per cent of iron. On the other hand, Bertrand and Villiers have found a small amount of manganese in the vegetable oxidases.

That oxidations also can proceed in certain cases without the aid of oxidizing enzyms is a well-known fact. But this is only the case with substances of a specific kind showing a great chemical energy, and even in such cases the presence of oxidizing enzyms will cause such a powerful increase of intensity that the difference becomes most striking, especially when chromogens consisting of certain derivatives of polyvalent phenols are present. The colored product (brown, red, or black) formed by oxidation will appear much sooner and in much greater quantity in the presence of certain oxidizing enzyms than in their absence.[2] On the other hand, oxidizing enzyms can bring on oxidations with certain compounds, as, for example, tyrosin, which under ordinary circumstances would not be oxidized at all by the indifferent oxygen of the air.

Bertrand has characterized different oxidases. While the oxidase of *Rhus vernicifera*, the Japanese lac tree, oxidizes mainly benzene derivatives containing at least two hydroxyl or two amido groups in ortho or para position, another oxidase, isolated from certain green plants, as well as from fungi, acts easily in tyrosin, which the former can not affect, therefore he distinguishes the latter as tyrosinase from the former as laccase. It is the laccase which acts upon the laccol in the juice of the lac tree and converts it by oxidation into a black substance. Laccase is killed at 75.5° C. (168° F.) and gives the guaiac reaction without the aid of hydrogen peroxide. Like laccase, the oxidases of *Senecio vulgaris*, *Lactuca sativa*, and *Taraxacum dens leonis* fail to attack tyrosin. In certain objects, especially in fungi, however, laccase and tyrosinase occur simultaneously.

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[1] This blue reaction can be obtained not only by the action of oxidizing enzyms, but also by that of powerful oxidizing chemicals. Such bodies (nitrous acid, free chlorine, etc.) are usually absent when the test for oxidizing enzyms is made. Any intelligent chemist will be able to decide at once by control experiments whether he can trace the reaction rapidly setting in to oxidases or not.

[2] The attempt to explain such rapid oxidations by the assumption that certain salts or ordinary albuminous matter would activify the oxygen, must be considered a failure.

The oxidation of polyvalent phenols by laccase leads not only to organic acids, but even to the production of carbonic acid. Bertrand observed in one case that for 23.3 cc. absorbed oxygen as much as 13.7 cc. of carbonic acid were produced.

Gouirand has observed in certain spoiled wines an oxidase[1] which oxidizes the coloring matter, the tannin, and the alcohol of the wine, with production of carbonic acid. This oxidase is destroyed in plain aqueous solution at 72.5° C. (162.5° F.), while in the wine a temperature of 60° C. (140° F.) suffices. Very small doses of sulphurous acid will also kill it. It is supposed to be derived from the fungus *Botrytis cinerea*, which frequently grows upon ripening grapes,[2] while Martinand and Tolomei observed an oxidase in ripe grapes. As to the Florida tobacco leaf, the writer has demonstrated the presence of a relatively large amount of oxidases in it.

These oxidizing enzyms belong, like other enzyms, to the protein compounds, forming a special group of labile proteins, i. e., proteins containing much chemical energy, which on the one hand is the cause of their activity and on the other of their changeability to indifferent proteids by heat, acids, and poisons. They are, as it is expressed, easily killed. The labile, active atomic groups in the molecules change thereby, the atoms migrating into more stable position.

Views on the physiological functions of the oxidizing enzyms.—As to the physiological function of the oxidizing enzyms, no perfectly satisfactory explanation has thus far been proposed. Some authors suppose that they are important agencies in the respiration process and that even respiration itself is caused by them when they are supported by certain properties of the living protoplasm. This is, however, improbable for several reasons: (1) Not every plant contains oxidizing enzyms; (2) many plants contain them only in certain stages; and (3) carbohydrates and fat, the materials which by their combustion serve for support of the respiration and for the production of energy, are not attacked by the oxidizing enzyms, but are attacked very energetically by the protoplasm.

Portier believes that the oxidase of the blood, of which he made a special study, serves to augment the vitality of the leucocytes, which prepare the oxidase and finally deliver it up to the blood when they die. This hypothesis will certainly not find support. The suggestion has also been advanced that the oxidizing enzyms play in plants the same part that the hæmoglobin does in animals, but neither is this view justified, as the oxidizing enzyms are not carriers of molecular oxygen, but simply instigators of oxidation.

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[1] This œnoxidase is supposed by Bertrand to be identical with laccase.

[2] See also Cazeneuve, Compt. rend., Vol. CXXIV.

The writer's view on this subject is that as the living protoplasm can oxidize carbohydrates and fat, but does not attack or attacks only with difficulty compounds of the benzene group, and, on the other hand, as just the opposite takes place with the oxidizing enzyms, it may be inferred that there exists between the protoplasm and the oxidizing enzyms a certain division of labor, the former oxidizing the compounds of the methan series and the latter those of the benzene series. The former provides for the kinetic energy of the cells; the latter destroys by partial oxidation noxious by-products. The oxidations in the former case are generally complete, but in the latter only partial.

The oxidizing action of enzyms might be compared to that of platinum black. In both cases chemical energy is conveyed to certain organic compounds, which are thus rendered capable of taking up the oxygen directly from the air. The further inference might also be justified that just as platinum black brings on not only oxidations, but also reductions under certain circumstances, the same may be possible for the oxidases; for example, if platinum black is added to a mixture of glucose and potassium nitrate in aqueous solution, a reduction of nitrate to ammonia takes place by aid of hydrogen atoms in the sugar, while the oxygen of the nitrate is thrown upon the glucose and organic acids thereby formed. When the analogy of action of the oxidase to platinum black is justified, there will be a simple explanation for the disappearance of a certain portion of the nitrate and also of a certain portion of the glucose during the fermentation process of tobacco. Preliminary qualitative experiments by the writer have indeed proved the formation of ammonia under these conditions. A full account of quantitative tests will follow in a later bulletin.

The oxidizing enzyms may occur in various parts of the plant—in young and active as well as in dormant tissue. Grüss has observed that there occurs frequently, but not always, a coincidence between the transformation of starch and increase of oxidase. Whether the amount of oxidase augments with the ripening of fruits has not been thoroughly investigated. Tolomei observed that in olives it does increase during the ripening process.

The juice of the fresh tobacco leaf soon turns dark upon exposure to air and gradually forms a sediment, but if boiled this dark coloration does not set in, the oxidase having been killed.

The tobacco oxidase and peroxidase.—There exist, evidently, two kinds of oxidizing enzyms in the Florida tobacco leaf. The first kind oxidizes guaiaconic acid (the characteristic reactive in the guaiac resin) to guaiac blue without the aid of peroxide of hydrogen, but the second kind oxidizes it only when this substance is present. Both kinds of oxidizing enzyms, which may be distinguished as tobacco oxidase and tobacco peroxidase, occur in the fresh as well as in the recently fermented Florida tobacco leaf.[1] The former enzym is, however, much more sensitive to heat than the latter, being killed at from 65° to 66° C. (149° to 151° F.), while the latter is killed only at from 87° to 88° C. (188.6° to 190.4° F.).

Dried tobacco leaf (not cured) was finely pulverized, and 1 gram of the powder left with 20 grams of water for one hour at the ordinary temperature. A part of the filtrate was heated for three minutes to 55° C. (131° F.). To about 2 cc. of this liquid were then added a few drops of tincture of guaiac,[2] whereupon a blue coloration appeared in a few minutes, exactly as in the control case. A second portion was now heated to 65° C. (149° F.) for three minutes, and the test applied after cooling, but only a slight trace of a blue color was noticed after ten minutes. Evidently most of the tobacco oxidase was destroyed at that temperature.

The killing temperature of the tobacco peroxidase was determined in a similar manner. However, here reaction is still obtained with great intensity after the solution is heated for three minutes to 80° C. (176° F.), but very feebly after heating for one minute to 87° C. (188° F.).

Another reaction for oxidizing enzyms is the so-called indophenol reaction, consisting in the production of a blue color when an alkaline solution of α naphthol with paraphenylendiamine is acted upon by an oxidase. This reaction must, however, quickly set in and with great intensity, otherwise no reliable conclusion can be drawn. Cured and fermented tobacco from Florida did not show this reaction in a marked manner,[3] but it set in at once upon the addition of a little peroxide of hydrogen. The latter alone will not produce this result in the absence of an oxidizing enzym.

In the manner above mentioned the writer's investigations have shown that dark tobacco two years old, from Quincy, Fla., yielded no reaction for tobacco oxidase, but still a moderate one for tobacco peroxidase, while a sample of light-colored tobacco four years old from the same source yielded not the slightest reaction either for the oxidase or the peroxidase. Evidently these enzyms themselves are gradually changed. From these observations it may be inferred that the cold sweat, or after-fermentation, might thus proceed for about two years and end by the gradual dying off of the oxidase and peroxidase.

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[1] French savants were the first to call attention to this difference between the oxidizing enzyms. The names oxidase and peroxidase, proposed by a French savant, are not specific names, but group names. There may exist among various oxidases and peroxidases as many differences as there are among protein bodies. Hence it is entirely unjustifiable, at this stage of our knowledge, to introduce one specific name for all peroxidases, as one author has done.

[2] In all these cases freshly prepared guaiac tincture (1:50) was employed, as old guaiac tincture is unreliable and with peroxide of hydrogen alone will sometimes yield a greenish coloration.

[3] Only a slow and weak reaction was thus developed.

When the fresh leaf of the tobacco is rapidly dried at about 60° C. (140° F.) and then moistened again and kept in a moist atmosphere, the veins and their finest ramifications turn brown in about half an hour, while the mesophyll and epidermal cells remain green even after a week. Further investigations on this point will be made later. In the fresh leaf, both oxidizing enzyms, the oxidase and the peroxidase occur in the ribs and veins as well as in the parenchyma, the indications being that they are more abundant in the ribs than in the parenchyma. The bundle sheath and sieve tissue give the most intense reaction on the oxidase, while the reaction on the peroxidase sets in quickly and with about uniform intensity in all the cellular tissues. The growing point and youngest leaves contain an especially large quantity of the oxidase. A section through the stalk shows oxidase only in the sieve tissue and bast parenchyma, while peroxidase also is contained in the pith.[1] Both enzyms are found in the root, the former more in the central and the latter in the peripheral parts and also in the flower. The stigma of the pistil and the stigmatic fluid also show strong reaction upon oxidase.

The two oxidizing enzyms are also contained in the young tobacco plants. Several dozen of these, measuring on an average not more than 3 to 4 cm. from the tip of the root to the plumula, were rubbed in a mortar with a little water and some sand. The filtrate gave a very intense reaction for oxidase,[2] and after this was destroyed by warming to 70° C. an intense reaction for peroxidase also.

A colorless clear solution of the tobacco peroxidase can be obtained in the following manner: A number of fresh tobacco leaves are well crushed in a mortar, with the addition of sand and some dilute alcohol of 30 per cent. This mixture is pressed and the turbid liquid directly mixed with three times its bulk of strong alcohol. After standing two hours the mixture is thrown upon a filter and the filter contents, after being washed with some alcohol, extracted with about four to six times its bulk of water at the ordinary temperature, heated for a minute to 70° C. (158° F.), and filtered. This clear, colorless filtrate gives no indication of the oxidase, but a very intense reaction for peroxidase. When this solution is compared with that of the juice of fresh tobacco leaves it is easy to decide what result is caused by the oxidase alone.

To determine whether the tobacco oxidase bears more resemblance to the tyrosinase or the laccase a few drops of freshly expressed juice of normal tobacco leaf were added to 2 cc. of a cold saturated tyrosin solution, but even after four hours no characteristic darkening of the mixture was observed. In this regard, therefore, that oxidase would resemble laccase more than it would tyrosinase.[1]

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[1] In order to observe the localization of the peroxidase small pieces of the tissue are treated with strong, but not absolute, alcohol for three minutes at 70° C. (158° F.). Thus the oxidase is killed and can not interfere with the tests for the peroxidase.

[2] The indophenol reaction did not turn out satisfactorily, only a weak violet-blue color resulting. On the addition of hydrogen peroxide, however, an intense blue reaction was at once obtained.

To extract oxidases from fermented or cured tobacco as completely as possible it is necessary to thoroughly pulverize the samples and to let the water act for some time at from 20° to 30° C. (68° to 86° F.) before filtering. After complete drying, the samples can be easily pulverized very fine. The following experiment proves that when the tissue is not pulverized the peroxidase is but very imperfectly extracted, the passage through the cellular walls being quite slow. Fermented tobacco leaves were three times soaked in water and the brown liquid pressed out, the first soaking lasting half an hour and the second and third soakings five minutes each. Although the sample was thus nearly exhausted, it nevertheless yielded, when left with some alcohol of 30 per cent for one day, a light-colored liquid with a very intense reaction for peroxidase.

It may safely be assumed that in the majority of instances the oxidase will prove the more energetic of the two oxidizing enzyms. For example, its action upon pyrocatequol and hydroquinone is much more energetic than that of the peroxidase. On the other hand, however, the former succumbs much more quickly to noxious influences, e. g., the action of alcohol or rising temperature.

The fact that the peroxidase forms guaiac blue from guaiaconic acid with the aid of hydrogen peroxide only does not indicate that its oxidizing action in every case depends upon the presence of the latter.[2] The peroxidase can, on the contrary, also exert oxidizing action upon various compounds without the assistance of hydrogen peroxide. Thus, para-amidophenol is gradually changed by it to a dark brown substance.

Hydroquinone in dilute solution gradually assumes a reddish color in the presence of the peroxidase, but in its absence there is scarcely a trace of coloration within twenty-four hours.

Pyrocatechol is scarcely attacked by the peroxidase within twenty-four hours, but on a further addition of a little hydrogen peroxide it turns to a dark brown in five minutes. Hydrogen peroxide added alone does not act thus.

Pyrogallol is slowly attacked by the peroxidase and turns brown in twenty-four hours. The oxidase acts also in this case much more energetically than the peroxidase.

Tannin solution shows in twenty-four hours a yellow color in the presence of the peroxidase, but in the control solution merely a slight trace of coloration is perceptible. The addition of a little hydrogen peroxide to both will increase the difference of coloration still more.

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[1] The peroxidase of tobacco on the other hand bears resemblance to the peroxidase of pus described by Linossier.

[2] The hydrogen peroxide is decomposed by enzyms into water and oxygen, but this oxygen in *status nascens* is charged with more chemical energy than the free oxygen of the air, i. e., the two atoms constituting the molecule are for a time in a more energetic motion than in the latter case, hence the action of the oxidizing enzyms is facilitated by this nascent oxygen.

All these tests were made at from 18° to 20° C. (64.4° to 68° F.). A number of other compounds were also tested, such as arbutin, guaiacol, and toluidine, but no decisive reaction was obtained within twenty-four hours at the ordinary temperature.

There may exist great differences in the amount of tobacco oxidase and tobacco peroxidase produced in different varieties of the tobacco plant and under different conditions. The quantity of each may even differ in the upper leaves fully exposed to the sun and the lower leaves growing mostly in the shade. There may also be formed compounds in certain varieties of tobacco that will more quickly destroy the enzyms during curing, or fermentation, than in other varieties. Thus considerable difference was noticed in comparing a sample of tobacco from Connecticut with one from Florida. In the fermentation of the former the tobacco peroxidase was almost completely destroyed, while in that of the latter a considerable part was still intact. Moreover, neither the fermented nor the cured Connecticut leaf contained any tobacco oxidase, although it was found in a greenhouse specimen of the fresh leaf.

It is interesting to note that the best way of bringing the oxidizing enzym to the fullest action possible is that practiced in the curing of the Perique tobacco.[1] The rolls, or twists, of the tobacco leaves are subjected to a pressure of about 7,000 pounds per square foot to bring the juice from the interior of the cells to the surface. After twenty-four hours the tobacco is taken out and aired a few minutes, which causes a darkening to set in. In this way the juice is reabsorbed by the tissues, whereupon the pressure is again applied. This operation is repeated daily for ten consecutive days, and at longer intervals thereafter. A very dark product is thus obtained, but it is not strong, as the oxidation of the nicotine has been carried very far.

One of the most interesting features of the sweating of tobacco is the destruction of a part of the nicotine, this part yielding up its nitrogen probably as ammonia, which is indeed a product of the sweating. It was, of course, of importance to prove that the oxidizing enzyms contained in the tobacco leaf can decompose nicotine, and for this purpose 50 grams of cured tobacco from Connecticut which had not yet been subjected to fermentation and showed a strong reaction for peroxidase, but none for oxidase, was thoroughly moistened with water. After two hours 250 cc. of alcohol of 50 per cent was added and the mixture allowed to stand for two days. The liquid obtained by pressing was now mixed with one and a half times its volume of absolute alcohol and the brown-colored precipitate washed upon the filter with some alcohol. After pressing between filter paper, the precipitate, containing a large proportion of the peroxidase, was dissolved in 20 cc. of water and 0.5 gram of nicotine tartrate added. This mixture was digested for two days at from 50° to 60° C. (122° to 140° F.) in a large flask, holding about 500 cc. of air, to enable oxidation to go on. An addition of a small amount of thymol prevented bacterial growth. A small U tube, holding 10 cc. of dilute chemically pure sulphuric acid of 0.2 per cent, was attached to the flask. The examination of this acid after two days with Nessler's reagent indicated that ammonia was present, but the colorimetric comparison showed that the amount was hardly more than 0.1 milligram. However, the amount of ammonia formed but not volatilized was much larger, as indicated by the strong reaction obtained after the addition of a little potassium carbonate to the mixture and warming for a short time in order to liberate the ammonia in the form of carbonate from other less volatile salts.[1] Thus there can be no doubt that the tobacco peroxidase can attack nicotine with formation of ammonia, but this process is exceedingly slow. Indeed, the sweating, lasting fully eight weeks, can diminish the nicotine content on an average only by about one-third.[2]

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[1] Farmers' Bull. No. 60, U. S. Dept. of Agr.

What the products of destruction of nicotine are besides ammonia can be determined only when the purified enzyms and a pure nicotine salt serve in large quantities for the experiment. It may be mentioned, however, that the writer has examined in vain an aqueous extract of fermented tobacco for nicotyrin and nicotinic acid—known oxidation products of nicotine.

The writer has now fully established the presence of oxidizing enzyms in the tobacco leaf.[3] That such enzyms can exert a powerful action upon certain compounds, leading even to the formation of carbonic acid, is known.[4] Oxidations produce heat, hence it can safely be inferred that the so-called tobacco *fermentation* consists in the activity of oxidases, while the *curing* of tobacco consists in the combined work of oxidases, diastase, and peptase. As the use of the term "fermentation" might lead in this case to an entirely erroneous conception, the writer proposes "oxidizing enzymosis" or "oxidizing enzymation" as correct scientific designations.

There has already been mentioned an interesting case of oxidase action in a technical branch, viz, the preparation of the Japanese lac. Furthermore, in the manufacture of the natural indigo bacteria are not concerned (Molisch), but simply an oxidizing enzym (Bréaudat).

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[1] The oxidase might have exerted a more powerful action on the nicotine than the peroxidase.

[2] A control experiment was made with a colorless peroxidase solution (p. 29) upon highly diluted free nicotine at the ordinary temperature, in order to observe whether a brown solution is produced by a change of the nicotine, but the mixture remained colorless after one day under these conditions. However, it may be mentioned that nicotine, when exposed a long time to air and light, will turn brown.

[3] He has already pointed out (p. 15) that there is sufficient access of air possible to enable oxidation in the tobacco piles.

[4] The further inference is certainly justified that certain basic compounds might thus give up their nitrogen in the form of ammonia.

Another instance where an oxidizing enzym plays a part in a technical branch is the "fermentation" of the olive, which is practiced in certain parts of Italy. It is believed that by this operation an oil of superior quality is obtained and that the yield by pressure is larger, but this has not been confirmed. It has been shown by Tolomei[1] that this olive "fermentation" is due to the action of an oxidizing enzym, to which also is due the fact that olive oil is bleachable by sunlight.

When the freshly gathered olives are kept in sacks their temperature gradually rises far above that of the rooms, oxygen is absorbed, and carbonic, acetic, and sebacic acids, and small quantities of the higher volatile fatty acids are formed. This process goes on to a larger extent when a temperature of 35° C. (95° F.) is reached. These changes do not occur if the olives are kept in nitrogen or carbonic acid gas; neither do they occur when the olives have been heated to 75° C. (167° F.) for forty-five minutes. For obvious reasons the spontaneous rising of temperature is noticed only when a large number of olives are kept together. Tolomei showed that the oxidase extracted with water and purified by a repeated precipitation with alcohol produces guaiac blue from guaiac tincture, forms purpurogallol from pyrogallol without the aid of peroxide of hydrogen, quinhydrone from hydroquinone, and a brown substance from gallic acid. He calls this oxidizing enzym olease. As unripe olives do not contain this olease, the oil pressed from them will not bleach upon exposure to the sunlight, but will do so after being shaken with an aqueous extract of the ripe olives. On the other hand, olive oil will sooner acquire rancidity in the presence of the olease than when free from it.

Finally, still another case may be pointed out where oxidases might possibly play a part—that is, in the so-called fermentation of the cacao beans, by which a bitter principle is destroyed.

SUMMARY.

(1) The so-called tobacco fermentation is not caused by bacteria.

(2) The amount of water present in normally fermenting tobacco leaves is insufficient to bring nourishment for the microbes from the interior of the cells to the surface of the leaves. It barely suffices for imbibition of the organic matter.

(3) There exists no bacterial coating on the fermenting tobacco leaves under normal conditions, but some spores may occur.

(4) In the so-called petuning of tobacco an immense number of bacteria may be transferred to the leaves. These bacteria, however, are not essential for the fermentation, but on the contrary, may prove noxious as soon as a small surplus of water enables them to further develop.

(5) Suchsland's theory that the aroma of tobacco is caused by specific bacteria is incorrect.

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[1] Atti della Reale Accademia dei Lincei, 1896, p. 122.

(6) The principal changes that take place during the curing and fermenting of tobacco are due to the action of soluble ferments or enzyms.

(7) Several kinds of enzyms act in the curing process, (*a*) an amylolytic, (*b*) a proteolytic, and (*c*) two oxidizing enzyms, while in the fermenting process the main changes are due to oxidizing enzyms alone, and consist in the oxidation of nicotine and other compounds.

(8) The presence of the amylolytic and the proteolytic enzyms is inferred from the saccharification of the starch and the decomposition of proteïds, but the enzyms themselves have not yet been isolated from the tobacco leaf.

(9) In green tobacco two oxidizing enzyms may exist, an oxidase and a peroxidase. The former succumbs much more readily to noxious influences than the latter and in all probability exerts a more powerful action.

(10) The development of color and aroma is due principally to the action of the oxidizing enzyms.

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